Europe Edition

KIKUSUI

Electronic Test &
Measurement Instruments, Power Supplies

KIKUSUI
PRODUCTS CATALOGUE
2013/2014

www.kikusui-europe.com

To be a global company contributing to our customer's manufacturing base with our creative technology and quality.

Electronic test and measuring instruments and power supplies are often called the "mother tools" of the industry. They are mandatory equipment for research, development and manufacturing premises, which are supporting the basis of electronics technology. KIKUSUI Electronics Corp. has been engaged in providing high-quality products as a specialized producer. In addition, we continue to strive to fulfill exact requirements for professionals and also to provide our original products in a timely manner with our "customer-centered" and "environment-considered" philosophy.

Moreover, KIKUSUI Electronics Corp. is now executing plans for globalization. Globalization of corporate activities has been our management theme, and today, the "global view" is critical to activities in worldwide environmental issues. Therefore, we would like to take a progressive approach to overseas projects in the future from the global point of view.

Our company's motto is "Be a person having a deep love, who is neat and clean like KIKU (chrysanthemum) and is flexible like Mizu (water, another way of reading, SUI) to go through everywhere." We understand the terms that "neat and clean" and "flexible" stand for a good faith and dedication as a specialized producer with a global view, and to act always on our customers' behalf.

"To promote expertise in measurement and power supplies and to be a global company contributing to our customers' manufacturing base with our creative technology and quality." It is that to look to the future with aspirations.

Company Profile

Head Quarters & Engineering Centre

Fuji-Katsuyama Factory

Corporate name	Kikusui Electronics Corp.
Founded and Incorporated	August 8, 1951
Capital	2,201 million yen
President & C.E.O	K. Kobayashi
Main activities	Manufacture, sale, and export & import of electronic test and measuring instruments, power supplies and software.
Headquarters	1-1-3, Higashiyamata,Tsuzuki-ku, Yokohama, 224-0023, Japan
Affiliate companies	Fujitek Corp. (Japan) Kikusui Trading (Shanghai) Co., Ltd. (China) Kikusui America, Inc. (U.S.A)
Main customers	Self-Defense Force Agency / Ministry of Education, Culture, Sports, Science and Technology / Japan Atomic Energy Research Institute / Nippon Telegraph and Telephone Corp. / Hitachi, Ltd. / Toshiba Corp. / Mitsubishi Electric Corp. / NEC Corp. / Fujitsu Ltd. / Panasonic Corp. / Sony Corp. / Sanyo Electric Co., Ltd. / Pioneer Electric Corp. / Kyocera Corp. / ALPS Electric Co., Ltd. / Murata Manufacturing Co., Ltd. / Toyota Co., Ltd. / Denso Corp. / Nissan Motor Car Co., Ltd. / Honda Motor Co., Ltd.
Main products	Power Supplies, Electronic Loads, Tele-communication Measuring Instruments, Withstanding Voltage Testers, Insulation Testers, Earth Continuity Tester, Calibrators, Signal Generators

History

1950s

1960s

1970s

1951	Kikusui Denpa established.
1962	Corporate name changed to Kikusui Electronics Corporation
1983	Fuji Katsuyama Factory established.
1986	Fujitec Co., Ltd. established as an affiliated factory of the Fuji Katsuyama Factory.
1988	Concluded exclusive agent contract with Marconi Instruments Ltd. (presently Aeroflex Incorporated), U.K. COM3000 Series Oscilloscope becomes the first category winner of the Good Design Award by MITI (Ministry of International Trade and Industry)
1991	Capital increased to 2,201,250,000 yen. Stock listed on domestic stock exchanges (November 22)
1993	Head office moved to Yokohama.
1994	Construction of Engineering Centre completed.
1995	ISO9001 certified by JQA.
1997	Construction of Head office.
2000	ISO14001 certified by JQA.
2004	Kikusui Electronics (Suzhou) Co.,Ltd. established in China. Kikusui America, Inc. established in the United States.
2006	Kikusui Trading (Shanghai) Co.,Ltd. established in China.

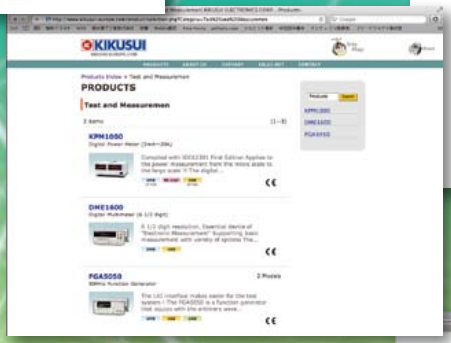
1980s

1990s

2000s

KIKUSUI WEB
www.kikusui-europe.com

We, Kikusui Electronics Corporation, would like to offer you as much as information through our Kikusui Web including about Company Profile of Kikusui, Full line of Kikusui products, Overseas distributors, Services, New technologies and Introduction of latest products.
We also uploaded for your convenience some of popular Instrument Drivers, which can be used with Lab VIEW or Visual Basic as Download Service.
Electronic Catalogues in PDF format are also available for each product through our Web for more detailed specification and quality printing.



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NOTE:

* All products contained in this catalogue are equipment and devices that are premised on use under the supervision of qualified personnel, and are not designed or produced for home-use or use by general consumers.
* Specifications, design and so forth are subject to change without prior notice to improve the quality.
* Product names and prices are subject to change and production may be discontinued when necessary.
* Product names, company names and brand names contained in this catalogue represent the respective registered trade name or trade mark.
* Colors, textures and so forth of photographs shown in this catalogue may differ from actual products due to a limited fidelity in printing.
* Although every effort has been made to provide the information as accurate as possible for this catalogue, certain details have unavoidably been omitted due to limitations in space.
* If you find any misprints or errors in this catalogue, it would be appreciated if you would inform us.
* Please contact us to confirm specifications, price, accessories or anything that may be unclear when placing an order or concluding a purchasing agreement.

NOTE: Markings

NEW — Identifies new products appearing in this years catalog.

COMING SOON

GPIB RS-232C USB — Products equipped with these interfaces as standard.

GPIB OPTION RS-232C OPTION USB OPTION — Products optionally available with these interfaces.

DRIVERS — Products supporting instrument drivers for VisualBasic, LabVIEW, LabWindows/CVI and IVI-COM.
Refer to the down load service for drivers at Kikusui Web site.

CE — CE marked products

LXI — LXI (LAN eXtention for Instrumentation)
LXI is a type of interface standard extended to an instrumentation platform based on industry standard Ethernet (LAN) technology.
The LXI Consortium is an industry consortium with over 50 of the top T&M companies such as Agilent Technology, VXI Technology sponsoring and developing this technology. (We, Kikusui Electronics Corp, are also a member of this consorthium)

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Selection

DC Power Supply

Multi Range DC Power Supply (CV/CC)

PWR Series

Three types of wide-range power supplies covering 80 V to 650 V

GPIB/RS-232C OPTION
USB OPTION

SWITCHING SYSTEM P.14

Variable-switching Regulated DC Power Supply (CV/CC)

PAS Series

Equipped with digital communication functions and a power-factor correction circuit.

GPIB/RS-232C OPTION
USB OPTION

SWITCHING SYSTEM P.17

1U Multi Range Programmable DC Power Suppy

PWX Series COMING SOON

New standard of rack mount power supply

USB
RS-232C
LAN
LXI

SWITCHING SYSTEM P.20

Dual-tracking DC Power Supply (CV/CC)

PMR Series

A multi-output system in a simple way with TP-BUS

GPIB/RS-232C OPTION
USB OPTION

* While Supplies Last

LINEAR (SERIES REGULATOR) SYSTEM P.22

High Reliability DC Power Supply (CV/CC)

PAN-A Series

Basic DC power supplies superior for general purpose use.

GPIB/RS-232C OPTION

LINEAR (SERIES REGULATOR) SYSTEM P.24

Programmable Bipolar Power Supply (CV/CC)

PBZ Series

Superior output characteristic by adopting the power amp system

GPIB/RS-232C
USB
LAN OPTION
LXI
DRIVERS

P.26

Power Supply Controller

Power Supply Controller

PIA4800 Series

Supporting multiple channels

GPIB/RS-232C
DRIVERS

P.30

Power Supply Controller

PIA4850

Digital control of DC power by USB!

USB
DRIVERS

P.32

AC Power Supply

High-performance Multifunctional AC Power Supply (CV/CF)

PCR-LE Series

New stage of AC power supply supporting new energy field NEW

GPIB/USB OPTION
RS-232C
LAN OPTION
LXI
DRIVERS

LINEAR SYSTEM P.34

Compact AC Power Supply (CV/CF)

PCR-M Series

Compact AC power supply using the PWM inverter method

GPIB/USB OPTION
RS-232C
DRIVERS

SWITCHING SYSTEM P.38

Electronic Load

Multifunctional Electronic Load (CC/CV/CR/CP)

PLZ-4W Series

GPIB/RS-232C USB DRIVERS

Suitable design for fuel cell, faster speed and lower voltage testing application of various devices!

P.41

Multifunctional Electronic Load (CC/CV/CR/CP)

PLZ-4WL Series

GPIB/RS-232C USB DRIVERS

NEW

High speed-large current DC electronic load (50 A/μs)

P.46

Multifunctional Electronic Load (CC/CV/CR/CP)

PLZ-4WH Series

GPIB/RS-232C USB DRIVERS

NEW

High-voltage electronic load 650 V! For EV and HEV high-voltage converters. With the booster, extended capacity at a low cost can be realized!

P.48

Modular Multifunction Electronic Load (CC/CV/CR/CC+CV/CR+CV)

PLZ-U Series

GPIB/RS-232C DRIVERS

Multi-channel load systems can be built easily! Operating multiple units in parallel offers large capacity!

P.52

Electronic Load (AC)

PCZ1000A

RS-232C DRIVERS

For load test of inverters or transformers used for Fuel Cell, UPS, or Solar power generation

P.58

Fuel Cell Impedance Meter

Fuel Cell Impedance Meter

KFM2005

GPIB/RS-232C USB DRIVERS

Possible to acquire the Tafel plot and the cole-cole plot of the micro fuel cell

P.60

Fuel Cell Impedance Meter

KFM2030

GPIB/RS-232C USB DRIVERS

Fuel cell characteristic, variation, and service life testing can be done with ease!

P.62

Battery Test System

Battery Test System

PFX2511

USB

NEW

Fully support charge and discharge measurement from basic test to simulation test

P.64

Battery Test System

PFX2000 Series

USB

Implementing sophisticated battery tests with ease.
A highly flexible system can be built

P.66

Selection

Safety Tester

Hipot Tester with Insulation Resistance Tester

TOS9200/9201

GPIB/RS-232C DRIVERS

Perfect design for system operation, introducing our top of the line of Hipot /Insulation Resistance testers

☞ P.72

Hipot Tester with Insulation Resistance Test

TOS9213S

GPIB/RS-232C

NEW

Suitable for the insulation testing of PV module

☞ P.75

High-voltage scanner

TOS9220/9221

Extended features of TOS9200/9201 for multi-channel testing application

☞ P.76

Hipot Tester (AC/DC)

TOS5101

High-end model of TOS series having AC, DC10 kV output

☞ P.82

Hipot Tester with Insulation Resistance Tester

TOS5300 Series

USB DRIVERS

NEW

A new standard for Hipot & Insulation Resistance testing applied to world-wide input voltage

☞ P.84

Hipot Tester (AC/DC)

TOS5051A

RS-232C

Capable to record and storage of the test data AC/DC Output 5 kV type

☞ P.89

Hipot Tester (AC)

TOS5050A

RS-232C

Capable to record and storage of the test data

☞ P.89

Insulation Resistance Tester

TOS7200

RS-232C

Complied with the test voltage -25 V to -1000 Vdc of the JIS C 1302-2002

☞ P.91

Ground Bond Tester

TOS6210

GPIB/RS-232C DRIVERS

Supports UL60950-1 - new standard for Information Technology Equipment (ITE)

☞ P.94

Ground Bond Tester

TOS6200

GPIB/RS-232C DRIVERS

Pursuing to maximize an easy operation, stylish design of Ground Bond tester

☞ P.94

Leakage Current Tester

TOS3200

GPIB/RS-232C USB

Complying with various safety standards for general electrical equipment, this tester is used for touch current and protective conductor current tests!!

☞ P.98

Measuring Instruments

Multifunctional Electronic Load (CC/CV/CR/CP)

DME1600

6 1/2 digit resolution, essential device of “Electronic Measurement” supporting basic measurement with variety of options

NEW

GPIB (DME1600GC)

USB

P.102

Function Generator

FGA5050

50 MHz arbitrary waveform generator The LXI interface makes easier for the test system!

NEW

GPIB (FGA5050GC)

USB

LAN

LXI

P.104

Digital Power Meter

KPM1000

Applies to the power measurement from the micro scale to the large scale!!

NEW

GPIB/USB (OPTION)

RS-232C

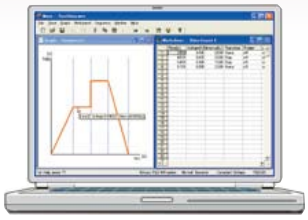
P.106

Software

Application Software for Power Supplies and Electronic Loads

WAVY

Easy-to-operate software expanding functions of power supplies and electronic loading units



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CE MARKING PRODUCT LIST

APPLICABLE MODELS FOR CE MARKING

DC Power Supply

Series	Model	Reference page	
PWR Series	all models	14	*1
PAS Series	all models	17	*1
PMR Series	all models	22	*1
PAN-A Series	PAN16-10A	24	*3
	PAN16-18A	24	*3
	PAN16-30A	24	*3
	PAN35-5A	24	*3
	PAN35-10A	24	*3
	PAN35-20A	24	*3
	PAN60-3A	24	*3
	PAN60-6A	24	*3
	PAN60-10A	24	*3
PBZ Series	all models	26	

Power Supply Controller

Series	Model	Reference page	
PIA Series	PIA4810	30	*1
	PIA4820	30	*1
	PIA4830	30	*1
	PIA4850	32	*1

AC Power Supply

Series	Model	Reference page	
PCR-LE Series	all models	34	*1
PCR-M Series	all models	38	*1

Electronic Load

Series	Model	Reference page	
PLZ-4W Series	all models	41	*1
PLZ-4WL Series	PLZ334WL	46	*1
PLZ-4WH Series	all models	48	*1
PLZ-U Series	all models	52	*1
PCZ1000A	PCZ1000A	58	*1

Fuel Cell Impedance Meter

Series	Model	Reference page	
KFM Series	KFM2005	60	*1
	KFM2030	62	*1

Battery Test System

Series	Model	Reference page	
PFX2500 Series	PFX2511	64	*1
PFX2000 Series	all models	66	*1

Safety Tester

Series	Model	Reference page	
TOS Series	TOS9200/9201	72	*1
	TOS9213S	75	*1
	TOS9220/9221	76	*1
	TOS5101	82	*3
	TOS5300	84	*1
	TOS5301	84	*1
	TOS5302	84	*1
	TOS5051A	89	*3
	TOS5050A	89	*3
	TOS7200	91	*1
	TOS6210	94	*1
	TOS6200	94	*1
	TOS3200	98	*1

Measuring Instruments

Series	Model	Reference page
DME1600	DME1600	102
	DME1600GC	102
FGA5050	FGA5050	104
	FGA5050GC	104
KPM1000	KPM1000	106

Option

Model	Reference page
TU02-PIA	30
OP01-PIA	31
OP02-PIA	31
TL01-TOS	100
TL02-TOS	100
TL03-TOS	100
TL04-TOS	100
TL05-TOS	100
TL06-TOS	100
TL07-TOS	100
TL08-TOS	100
TL11-TOS	100
TL12-TOS	100
RC01-TOS	100

ORDERING INFORMATION

*1.CE Marked model is available at all standard Input voltage as specified in each specification.
*2.CE Marked model is available only for the unit equipped with Input voltage of 210 V to 250 V.
*3.CE Marked model is available only for the unit equipped with Input voltage of 230 VAC.
* Please indicate 'CE Marked Products' when ordering or request for the quote.

Multi Range DC Power Supply (CV/CC)

PWR Series

GPIB OPTION RS-232C OPTION USB OPTION CE

TYPE II (800W TYPE)

TYPE III (1600W TYPE)

TYPE I (400W TYPE)

Dimensions / Weight

Type I :106.5(4.19″)W × 124(4.88″)H × 400(15.75″)Dmm / 5kg(11.02 lbs.)
Type II :214(8.43″)W × 124(4.88″)H × 400(15.75″)Dmm / 8kg(17.64 lbs.)
Type III :428.5(16.87″)W × 128(5.04″)H × 400(15.75″)Dmm / 15kg(33.07 lbs.)

Accessories

Operation manual, TP-BUS connector, Output terminal screws (M4, M8), Output protection cover
Type I :2.4 m power supply cable with 3-pin plug
Type II :3 m power supply cable with 3-pin plug
Type III :3 m power supply cable with no plug, Cable clamp

Three types of Wide-Range Power Supplies Covering 80 V to 650 V

The PWR Series offers constant voltage (CV)/constant current (CC) automatic crossover DC power supplies that enable you to combine a wide range of voltages and currents within the output power rating. For example, the model that has an output power rating of 1600 W (PWR1600L) provides a seamless operation range from 80 V - 20 A to 16 V - 100 A. With a single PWR Series power supply alone, you can cover an extensive output range equivalent to what is provided by three to six conventional single range DC power supplies. L type can output up to 160 % of the output current rating (in the continuous and intermittent extended operation areas). PWR1600L supports a maximum output of 10 V - 160 A.

Features

- Supports a digital communication function (TP-BUS) as standard.
- Analog external control functions are available, providing voltage- and resistance-based output voltage and current controls.
- Comes standard with the remote monitoring function. External analog monitoring can be done with respect to the output voltage, output current, and operation mode.
- A built-in power factor correction circuit (with power factor 0.98) for harmonic current suppression, as well as a highly efficient switching circuit (efficiency 70 %).
- A four-digit display can display the voltage, current, and power (W).
- Front-side output terminals (up to 30 A) for desktop use.
- A universal AC input supports a range of voltages from 100 V to 240 V.

Functions

■ Seamless five times variable voltage/current range (Note: For H type, 3.25-time variable voltage/current range)

A single PWR Series power supply supports an extensive operation range, covering an output range equivalent to what is provided by several conventional single range DC power supplies. Also, the maximum output powers of the power supplies of this series are 400 W, 800 W, and 1600 W - slightly higher than those of their predecessors. You can conduct tests without worrying about power limits.

■ Best for testing a wide variety of high-voltage devices including margin tests

The maximum output voltage of L type is 80 V. For example, 150 % of 42 V (63 V) can be supplied for testing vehicular electrical components, or 150 % of 48 V (72 V) can be supplied for testing communication equipment. In addition, the M type (320 V) is suitable for checking designs of energy-saving circuits for flat display panels and the development of new materials, while the H type (650 V) can be used to test various components and devices that use high voltages such as automotive devices, photovoltaic inverters, and many more.

■ Two extended operation areas where up to 160 % of the output current rating can be output (L type only)

In the extended operation areas, the power supply can output up to 160% of the output current rating. This feature is convenient when testing an automobile motor or other load device that requires high current at startup time. Since the power supply can output continuous current up to 120 % of the output current rating with the restricted ambient temperature range and current up to 160 % of the output current rating with the restricted output time tests can be conducted with a power capacity one rank lower. This feature also helps you cut equipment costs and save floor space.

■ Parallel or serial operation

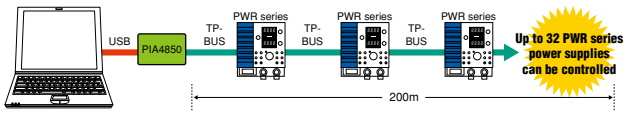
Parallel operation enables multiple power supplies of the same model to operate in parallel, offering a large capacity of up to 8 kW (when five 1600-watt models are connected in parallel). In a serial operation, the voltage can be increased up to 160 V.

(Note: • Parallel and serial operations cannot be done at the same time.
• Serial operations are not possible for the M and H types.)

■ Up to 32 PWR Series power supplies can be controlled with one GPIB address

The PWR Series supports a digital communication function (TP-BUS) as its standard feature. When used with a power supply controller (PIA4850) to be purchased separately, the function enables up to 32 PWR Series power supplies to be controlled using USB interface. In addition, the sequence generation software (Wavy for PAS & PWR), also to be purchased separately, allows even those users who have no knowledge of any programming language to exert output control over the PWR Series power supplies with sequence patterns of their choice and to read resultant data through the use of a PC.

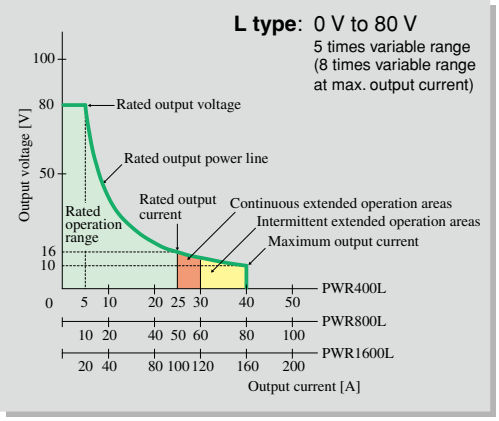
(Note: For controlling via GPIB or RS-232C, please use PIA4830.)

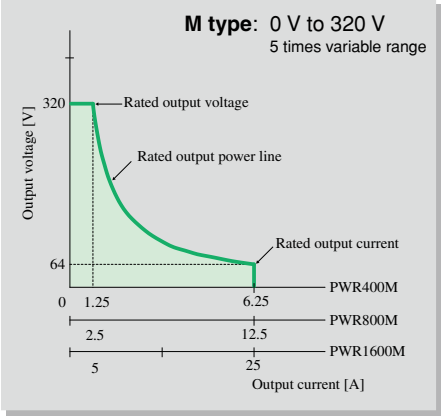


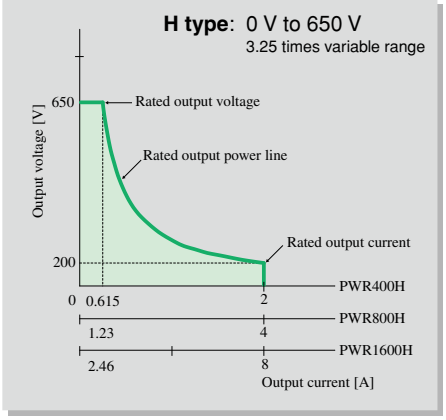
*For the details, please refer to page 32 .

Operation Area

Note: The ambient temperature and output time are restricted in the extended operation areas.







Options

■ Accessory Kit

OP01-PAS

(used for the connection of J1 connector on the rear panel when operating by external control)

● Connector, Semi-cover, Pin 10 pcs., Ground cable

■ Carrying Handle (for 400 W model)

CH01-PWR

■ Sequence Creation Software

Wavy for PAS & PWR

[NOTICE]

Because a noise filter is used for the primary input for the PWR Series, the leakage breaker, etc. may be activated, depending on the environment of the input power, when using multiple quantities of them at the same time. Therefore, we provide models for customers who are planning to use multiple devices at the same time. If you have any other questions, please contact our sales department for details.

PWR Series Specifications

Model		Output			Constant voltage (CV) characteristics				Constant current (CC) characteristics			Power input/Miscellaneous		
		CV	CC	Rated power	Ripple	Line regulation	Load regulation	Transient response	Ripple	Line regulation	Load regulation	Input current	Inrush current	Weight
		V	A	W	mVrms	0.05 % + mV	0.05 % + mV	ms	mArms	0.1 % + mA	0.1 %+mA	AC (100/200 V) A	Apeak (Max)	kg (approx.)
L type	PWR400L	0~80	0~25 MAX 40*	400	10	3	5	1	40	10	10	6.5/3.3	35	5
	PWR800L		0~50 MAX 80*	800	15	3	5	1.5	80	10	10	13.0/6.5	70	8
	PWR1600L		0~100 MAX 160*	1600	20	3	5	2	160	10	10	26.0/13.0	140	15
M type	PWR400M	0~320	0~6.25	400	15	3	5	4	25	10	10	6.25/3.13	35	5
	PWR800M		0~12.5	800	20	3	5	8	35	10	10	12.5/6.25	70	8
	PWR1600M		0~25	1600	25	3	5	12	50	10	10	25.0/12.5	140	15
H type	PWR400H	0~650	0~2	400	20	3	5	6	10	10	10	6.0/3.0	35	5
	PWR800H		0~4	800	30	3	5	7	20	10	10	12.0/6.0	70	8
	PWR1600H		0~8	1600	40	3	5	8	40	10	10	24.0/12.0	140	15

* The L type offers extended operation areas equivalent to up to 160 % of the output current rating. Some of the specifications may not be satisfied in the extended operation areas.
• Continuous extended operation area (up to 120 % of the output current rating): Continuous current output is enabled. However, derating occurs at an ambient temperature 30 ˚C or higher.
• Intermittent extended operation area (120 % to 160 % of the output current rating):
Continuous current output is enabled for 10 minutes or less. However, a nonoperating period more than twice the output period must be taken.

■ Input power..... 100 to 240 VAC (85 to 250 VAC), single-phase
50 to 60 Hz (47 to 63 Hz)
■ Power factor..... 0.98 standard
■ Efficiency..... 70 % or greater
■ Temperature coefficient ..... 100 ppm/˚C for constant voltage output
200 ppm/˚C for constant current output
■ Measuring meters
● Voltmeter..... (23 ˚C ±5 ˚C) Maximum display (fixed point):
99.99 (L type), 999.9 (M and H types)
Display error: ±(0.2 % of rdg* + 5 digits) * rdg = reading
● Ammeter..... (23 ˚C ±5 ˚C) Maximum display (fixed point)

Maximum output current	Maximum display digits
Models supporting 10 A or less	9.999
Models supporting 10 to less than 100 A	99.99
Models supporting 100 A or greater	999.9

Display error: ±(0.5 % of rdg* + 5 digits) * rdg = reading
■ Protection function...
● Over voltage protection (OVP):
Setting range (10 % to 110 % of the rated output voltage)
● Over current protection (OCP):
Setting range: (10 % to 110 % of the rated output current) for the M and H types
Setting range: (10 % to 176 % of the rated output current) for the L type
● Over power protection (OPP):
Approx. 110 % of the rated output power or greater
● Over heat protection (OHP):
Operates due to an internal temperature rise.
● Power limit (POWER LIMIT):
Power limit imposed at approx. 105 % of the rated output power.
■ Parallel operation.. Up to 5 units including master (of same model)
■ Serial operation .... Up to 2 units including master (of same model, for the L type only)
■ Digital control..... TP-BUS (directly controllable from PIA4810/PIA4830)
■ Monitor signal output... VMON (at rated voltage output),
IMON (at maximum current output): 10.00 ±0.25 V
■ Status signal output... OUT ON/CV/CC/ALM/PWR OFF/PWR ON

■ Environmental conditions ..... Operating ambient temperature range: 0 ˚C to + 50 ˚C
Derating occurs on output current at 45 ˚C or higher for the L type and 40 ˚C or higher for the M/H types.
● Operating ambient humidity range: 20 % to 85 %rh (non-condensing)
● Storage temperature range: -25 ˚C to +70 ˚C
● Storage humidity range: 90 %rh or less (non-condensing)
■ Cooling system..... Forced air cooling
(thermal control: Fan control function attached)
■ Ground polarity..... Negative or positive ground polarity possible.
■ Ground voltage..... ±600 Vmax for the L and M types
±1000 Vmax for the H type
■ Electromagnetic compatibility ... Conformance to the requirements of the directives and standards below.
EMC Directive 89/336/EEC
EN61326: 1997/A2 : 2001 Emission: Class A
Immunity: Minimum immunity test requirements
EN61000-3-2: 2000
EN61000-3-3: 1995/A1: 2001
*Not applicable to custom-made modified products.
*Only those models with CE marking provided on their panel.
■ Safety ..... Conformance to the requirements of the directive and standard below.
Low Voltage Directive 73/23/EEC
EN61010-1: 2001 Class I, Overvoltage Category II, Pollution Degree 2
■ Dimensions..... 400-watt type: 106.5 W × 124 (145) H × 400 (470) D mm
800-watt type: 214 W × 124 (155) H × 400 (470) D mm
1600-watt type: 428.5 (450) W × 128 (150) H × 400 (470) D mm
*Enclosed in parentheses are maximum dimensions.
■ Accessories..... ● Instruction manual
● Power cord
(400-watt type: Approx. 2.4 m in length, with a plug
800-watt type: Approx. 3 m in length, with a plug
1600-watt type: 3 m in length, without a plug)
● Rear side output terminal protection cover
● TP-BUS connector
● J1 dummy connector
● Output terminal screws etc.

Variable-switching Regulated DC Power Supply (CV/CC)

PAS Series

GPIB OPTION RS-232C OPTION USB OPTION CE

TYPE I (350 W TYPE) TYPE II (700 W TYPE) TYPE III (1000 W TYPE)

Dimensions / Weight

Type I :71(2.8″)W × 124(4.88″)H × 350(13.78″)Dmm / 3kg(6.61 lbs.)
Type II :142.5(5.61″)W × 124(4.88″)H × 350(13.78″)Dmm / 5kg(11.02 lbs.)
Type III :214(8.43″)W × 124(4.88″)H × 350(13.78″)Dmm / 7kg(15.43 lbs.)

Accessories

Operation manual, power cord (350 W/700 W TYPES: approx. 2.4 m long, with 3 P plug/1000 W TYPE: approx. 3 m long, without plug), Rear output terminal protection cover, TP-BUS connector, J1 dummy plug for protection, Output terminal screws (M4/M8)

Options

■ Accessory Kit
OP01-PAS
(used for the connection of J1 connectoron the rear panel when operating by external control)
● Connector, Semi-cover, Pin 10 pcs., Ground cable

■ Extended Terminal
ET-11

■ Sequence Creation Software
Wavy for PAS & PWR

Equipped with digital communication functions and a power-factor correction circuit.

The PAS Series consists of sophisticated variable-switching DC power supplies that refine and add to the advances of our conventional PAK-A Series. While the cabinet size remains unchanged from conventional models, the PAS Series incorporates a high-efficiency switching circuit and a power-factor correction circuit to meet the needs of today's users. Provided with Kikusui-developed digital communication functions (TP-BUS: Twist Pair Bus) as standard equipment, this series can handle power supply systems ranging from small scale (two units) to large scale systems (up to 448 channels in combination with power supply controllers of the PIA4800 Series via GPIB) at low cost. The distance between the controller and power supplies can be extended up to 200 m for use in applications such as plant power supply control from the PC at office.

Features

■ Equipped with a power-factor correction circuit
■ High power conversion efficiency of 75 %(TYP.)
■ Equipped with digital communication functions
■ Four-digit indication display unit
■ Multifunction dial
■ Supporting universal AC input

Functions

■ Attractive new design

The dynamic new color scheme of the PAS Series features a gray-white base with a front louver in vibrant blue. Models in this series are controlled with a multifunction dial and feature a high-brightness four-digit indication display unit. Display digits provide readings down to 10 mV/1 mA, and a output power (W) display function is also provided. The end result is improved operability and visibility.

■ Handling margin testing with capacity

The maximum rated output voltage of conventional products is typically a range consisting of 6 V, 10 V, 20 V, 35 V, and 60 V. The PAS Series offers a maximum rated output voltage of 10 V, 20 V, 40 V, 60 V, 80 V, 160V, 320V, and 500V, in response to changes in the voltage ranges required for margin testing due to the conversion of equipment such as DC-DC converters, batteries, automobile electrical components, and motor-operated tools to high voltage or large capacity formats. This allows the PAS Series to handle tests at 150 % of 24 V (36 V) or at 150 % of 48 V (72 V) with capacity to spare.

■ External analog control functions

- Constant-voltage/constant-current output control function
  Output control based on external voltage (0 V to 10 V)
  Output control based on external resistance (0 Ω to 10 kΩ)
- Output ON/OFF control function
  External contact-based output ON/OFF control
- Power switch control function
  External contact-based power switch OFF control

■ Analog read-back function

- Monitor output (voltage output)
  Output voltage monitoring
  Output current monitoring
- Status signal output (contact signal output)
  CV mode signal, CC mode signal, Output ON signal, Alarm signal, POWER ON signal

■ High efficiency and high power factor

The PAS Series employs a high-efficiency switching circuit that inherits its core circuit from the PAK-A Series, achieving a power conversion efficiency of 75 % (70 % or better for 10 V models). Models in the series incorporate a power-factor correction circuit with a power factor of 0.98 that suppresses higher harmonic currents. The PAS Series reduces power consumption cost, as well as heat-dissipation design cost, when the system is configured.

■ Parallel and series operation

For master/slave use, the PAS Series handles parallel (current expansion) and series (voltage expansion) operations. The maximum number of units that can be connected in series is two, while the maximum number of units connectable for parallel applications is five for the 350 W type, three for the 700 W type, and two for the 1000 W type.

* The same model types must be used for a given operation. The units cannot be connected in series and parallel simultaneously.

320 V model and 500 V model can not be connected in Series configuration.

■ High-resolution meter displays power (W)

Four digits are used to display output voltage/current at the same time. The configurable digits are more brightly lit than the others, to ensure easy and safe verification/ operation. The output power is also displayed. You can set the output voltage/current while monitoring the output power [Voltmeter measurement accuracy: ± (0.2 % of rdg + 5 digits) ammeter measurement accuracy: ± (0.5 % of rdg + 5 digits)].

* The maximum number of digits displayed on the ammeter (i.e. the location of the decimal point) varies according to the model.

Maximum Output Current	Maximum Display
Model less than 10 A	9.999
Model above 10 A less than 100 A	99.99
Model above 100 A, PAS500-0.6	999.9
PAS500-1.2, PAS500-1.8	9999

* Current value for 500 V models are displayed at the unit of (mA)

■ Universal mode available for AC input

For AC input, a universal mode (continuous between 100 V and 240 V) is used instead of a 100 V/200 V switchover type. The AC power connector* (AC inlet) used ensures safe and easy connections.

* Only with 350 W types and 700 W types. For 1,000 W types, a terminal block is used.

■ Front-panel auxiliary output terminal

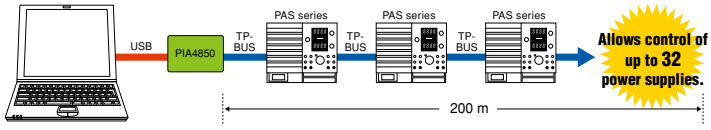
A front-panel auxiliary output terminal helps you to remove outputs with ease. Please note, however, that an accident may result in the event of inadvertent user contact. Moreover, this terminal can use only a limited current. Thus, when a large amount of power is used, the maximum load can not be realized. To meet your needs, Kikusui offers the extended ET-11 terminal, available as a separate option.

■ Digital communication function

In addition to output control based on external voltage, external resistance, or contact signal (so-called external analog inputs), the PAS Series offers a digital remote control read-back function (TP-BUS: Twisted Pair Bus) as standard equipment. This TP-BUS enables a single power supply controller (PIA4850) to control up to 32 PAS Series units.

(Note: For controlling via GPIB or RS-232C, please use PIA4830.)

● Example of connection using TP-BUS



*For the details, please refer to page 32 .

[NOTICE]

Because a noise filter is used for the primary input for the PAS Series, the leakage breaker, etc. may be activated, depending on the environment of the input power, when using multiple quantities of them at the same time. Therefore, we provide models for customers who are planning to use multiple devices at the same time. If you have any other questions, please contact our sales department for details.

PAS Series Specifications

Model	Output		Constant Voltage				Constant Current			Other			
	CV	CC	Ripple	Line regulation	Load regulation	Transient response	Ripple	Line regulation	Load regulation	Input current	Rush current	External dimensions	Weight
	V	A	mV rms	mV or less	mV or less	ms (typical value)	mA rms	mA or less	mA or less	AC (100 V/200 V)A	Ap to peak(Max)	TYPE	kg (approx.)
PAS10-35	0 to 10	0 to 35	7	8	10	1	77	45	45	5.0 / 2.5	35	I	3
PAS10-70	0 to 10	0 to 70	11	8	10	1	185	80	80	10.0 / 5.0	70	II	5
PAS10-105	0 to 10	0 to 105	14	8	10	1	277	120	120	15.0 / 7.5	105	III	7
PAS20-18	0 to 20	0 to 18	7	13	15	1	40	28	28	5.0 / 2.5	35	I	3
PAS20-36	0 to 20	0 to 36	11	13	15	1	95	46	46	10.0 / 5.0	70	II	5
PAS20-54	0 to 20	0 to 54	14	13	15	1	143	69	69	15.0 / 7.5	105	III	7
PAS40-9	0 to 40	0 to 9	7	23	25	1	20	19	19	5.0 / 2.5	35	I	3
PAS40-18	0 to 40	0 to 18	11	23	25	1	48	28	28	10.0 / 5.0	70	II	5
PAS40-27	0 to 40	0 to 27	14	23	25	1	71	42	42	15.0 / 7.5	105	III	7
PAS60-6	0 to 60	0 to 6	7	33	35	1	13	16	16	5.0 / 2.5	35	I	3
PAS60-12	0 to 60	0 to 12	11	33	35	1	32	22	22	10.0 / 5.0	70	II	5
PAS60-18	0 to 60	0 to 18	14	33	35	1	48	33	33	15.0 / 7.5	105	III	7
PAS80-4.5	0 to 80	0 to 4.5	7	43	45	1	10	14.5	14.5	5.0 / 2.5	35	I	3
PAS80-9	0 to 80	0 to 9	11	43	45	1	24	19	19	10.0 / 5.0	70	II	5
PAS80-13.5	0 to 80	0 to 13.5	14	43	45	1	36	28.5	28.5	15.0 / 7.5	105	III	7
PAS160-2	0 to 160	0 to 2	10	83	85	2	5	7	7	5.0 / 2.5	35	I	3
PAS160-4	0 to 160	0 to 4	15	83	85	2	10	9	9	10.0 / 5.0	70	II	5
PAS160-6	0 to 160	0 to 6	20	83	85	2	15	11	11	15.0 / 7.5	105	III	7
PAS320-1	0 to 320	0 to 1	15	163	165	2	5	6	6	5.0 / 2.5	35	I	3
PAS320-2	0 to 320	0 to 2	20	163	165	2	5	7	7	10.0 / 5.0	70	II	5
PAS320-3	0 to 320	0 to 3	30	163	165	2	10	8	8	15.0 / 7.5	105	III	7
PAS500-0.6	0 to 500	0 to 0.6	20	253	255	2	5	5.6	5.6	5.0 / 2.5	35	I	3
PAS500-1.2	0 to 500	0 to 1.2	30	253	255	2	5	6.2	6.2	10.0 /5.0	70	II	5
PAS500-1.8	0 to 500	0 to 1.8	40	253	255	2	5	6.8	6.8	15.0 / 7.5	105	III	7

■ Input voltage ..... 100 to 240 V AC (85 to 250 V AC), single phase, 47 to 63 Hz

■ Power factor ..... 0.98 typical value

■ Efficiency ..... 75 % or better (70 % or better for 10V models) *TYP

■ Temperature coefficient .. Constant-voltage output: 100 ppm/°C typ.
Constant-current output: 200 ppm/°C typ.

■ Indication meters

- Voltmeter (23±5 °C) ..... Maximum display: 99.99, Four-digit green LED display(Model below 80 V) 999.9 (Model above 160 V)
  Measurement accuracy: ± (0.2 % of rdg* + 5 digits)
- Ammeter (23±5 °C)..... Maximum display: Four-digit green LED display

Maximum output current	Maximum display digits
Model less than 10A	9.999
Model above 10A less than 100A	99.99
Model above 100A, PAS500-0.6	999.9
PAS500-1.2, PAS500-1.8	9999

* Current value for 500V models are displayed at the unit of (mA)

Measurement accuracy: ± (0.5 % of rdg* + 5digits)
* rdg = reading

■ Protective circuits

- Overvoltage protection... Voltage setting range: 10 % to 110 % of rated output voltage
- Overcurrent protection... Current setting range: 10 % to 110 % of rated output current
- Overheat protection ..... Activated by elevated internal temperatures

■ Environmental conditions
Ambient temperature ..... 0 to 50 °C
range for operation
Ambient humidity ..... 20 to 85 %rh
range for operation
Storage temperature range....-25 to 70 °C
Storage humidity range... 90 %rh or less

■ Cooling system..... Fan-based forced-air cooling, front air-intake

■ Voltage to ground..... ±500 V (±600 V: 500 V model)

■ Safety ..... Conforms to the requirements of the following directive and standard.
Low Voltage Directive 73/23/EEC
EN61010-1
Class I
Pollution degree 2

■ EMC..... Conforms to the requirements of the following directive and standard.
EMC Directive 89/336/EEC
EN61326
EN61000-3-2
EN61000-3-3

■ External dimensions ..... Type I: 71 W 124(150) H 350(420) D mm
(MAX) Type II: 142.5 W 124(160)H 350(420) D mm
Type III: 214 W 124(160)H 350(420) D mm

■ Accessories .....
- Operation manual
- Power cord
  (350 W/700 W TYPES: approx. 2.4 m long, with 3 P plug
  1000 W TYPE: approx. 3 m long, without plug)
- Rear output terminal protection cover
- TP-BUS connector
- J1 dummy plug for protection
- Output terminal screws (M4/M8)

1U Multi Range Programmable DC Power Suppy

PWX Series

USB RS-232C LAN LXI CE

COMING SOON

New Standard of Rack Mount Power Supply

The PWX Series offers constant voltage (CV)/constant current (CC) automatic crossover DC power supplies that enable you to combine a wide range of voltages and currents within the output power rating. A single PWX Series can cover an extensive output range equivalent to what is provided by several units of a conventional single range DC power supply. Also, the 1U design is suitable for a rack mount, enabling it to fit into a minimal amount of space in the rack. This makes it possible to improve packaging density and save space.

Dimensions / Weight

750 W type : 422.8(16.65″)W × 43(1.69″)H × 500(19.69″)Dmm/ 8kg(17.64 lbs.)
1500 W type : 422.8(16.65″)W × 43(1.69″)H × 500(19.69″)Dmm/ 9.5kg(20.94 lbs.)

Accessories

Output terminal cover, Input terminal cover set(1500 W type), Output terminal M6 bolt set(Type I)(Bolt, nut, spring washer, and washer for each bolt, Output terminal M8 bolt set(Type II)(Bolt, nut, spring washer, and washer for each bolt, Chassis connection wire, J1 connector plug kit, Packing list, CONFIG parameter list, Safety precautions, China RoHS sheet, CD-ROM

Features

- Variable voltage and current combinations with 3 times of coverage ratio of its range within the rated power
- 1U height, slim and lightweight design, suitable for rack mount
- Expandable output capacity by parallel operation (up to 4 units by the same model)
- Expandable output voltage by series operation (up to 2 units by the same model)
- Memory function (3 combinations of settings for voltage, current, OVP, OCP, and UVL)
- Bleeder circuit ON/OFF setting (to prevent over-discharging of batteries)
- Selectable operation mode when turning the output "ON" (CV, CC priority start function)
- Command language setting function: Command compatibility mode widely used in grobal manufactures
- Using optional isolated analog interface (factory option), it can be controlled by the power supply output and the isolated signal

Specifications

Model	Output		Rated Power	Weight
	V	A	W	kg/lb
PWX750LF	0 to 30	0 to 75	750	8/17.64
PWX750MLF	0 to 80	0 to 28		
PWX750MHF	0 to 230	0 to 10		
PWX750HF	0 to 650	0 to 3.5		
PWX1500L	0 to 30	0 to 150	1500	9.5/20.94
PWX1500ML	0 to 80	0 to 56		
PWX1500MH	0 to 230	0 to 20		
PWX1500H	0 to 650	0 to 7		

Options

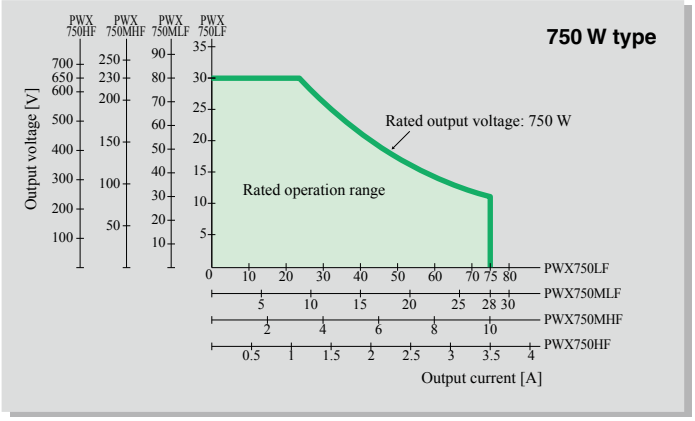
■ AC cable
AC1-3P2R5M-IEC320-EU(for 750 W model, with plug)
AC cable (for 1500 W model)

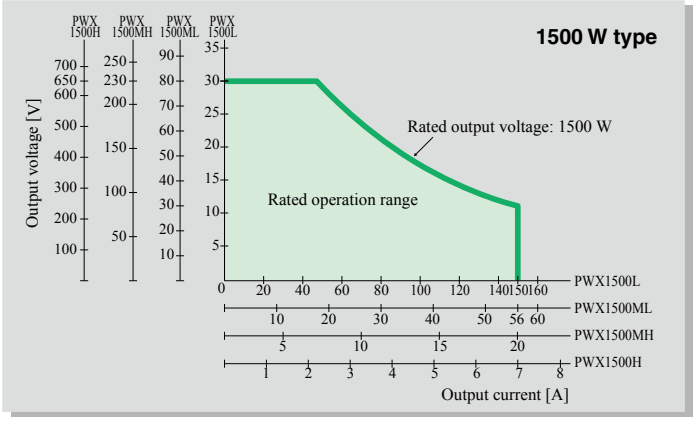
■ Parallel operation cable
PC01-PWX (for 2 units in parallel)
PC02-PWX (for 3 units in parallel)
PC03-PWX (for 4 units in parallel)

■ Sequence Creation Software
Wavy for PWX

■ RS232C control conversion cable
RD-8P/9P

Operation Area

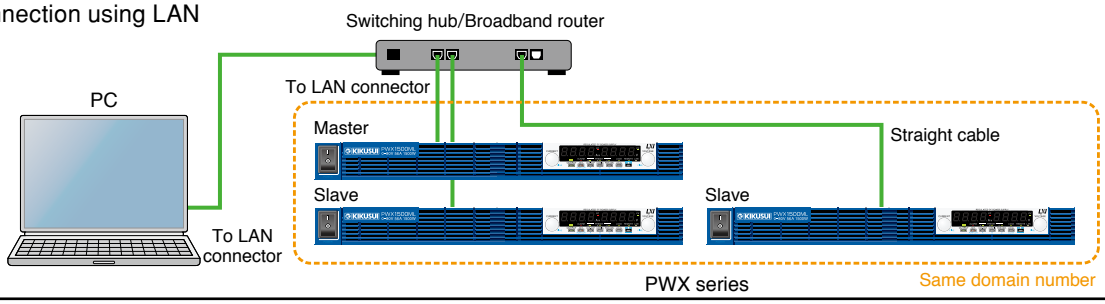




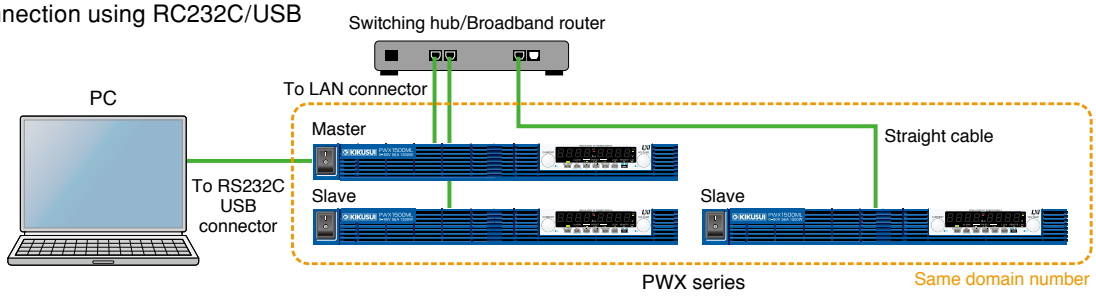
Connecting with multi-channels

Connecting with the PC by the one Master unit (LAN/RS232C/USB interface). Other PWX units are assigned as the slave units connecting with the Master unit using the switching hub/broad band router by LAN interface. Use the standard LAN cable when connecting with the LAN interface.

● Example of connection using LAN



● Example of connection using RC232C/USB



Common Specifications

Protection function ····· OVP (over voltage protection), OCP (over current protection), UVL (under voltage limit), OHP (over heat protection), FAN (fan failure protection), SENSE (incorrect sensing connection orotection), AC-FAIL (low AC input protecion), SD (shut down), POWER LIMIT (power limit)

External analog control ····· CV mode
External voltage: CV external voltage control (0 V to 5 V/ 0 V to 10 V)*1*2
External resistance: CV external resistance control, normal and fail-safe (0 Ω to 10 kΩ)
CC mode
External voltage: CC external voltage control (0 V to 5 V/ 0 V to 10 V)*1*2
External resistance: CC external resistance control, normal and fail-safe (0 Ω to 10 kΩ)
ON/OFF: OUTPUT ON/OFF, SHUT DOWN (TTL level)*3

Parallel operation ····· Up to 4 units including master (of same model)

Serial operation ····· Up to 2 units (of same model)

Monitor signal output *4 ····· V MON (voltage monitor): 0 V ± 5 V/ 0 V ± 10 V during rated voltage output
I MON (current monitor): 0 V ± 5 V/ 0 V ± 10 V during maximum current output

Status signal output *5 ····· OUT ON, CV, CC, ALM, PWR ON

Input voltage range ····· 100 VAC to 240 VAC, single-phase, 50 Hz to 60 Hz

Power interruption hold-up time (min.)····20 ms or greater

Power factor (TYP) ..... 0.99 (input voltage 100 V), 0.97 (input voltage 200 V)

Efficiency (MIN) ..... 74 % or more

Operating ambient temperature .. 0 °C to 50 °C

Operating ambient humidity··· 20 % rh to 85 % rh (non-condensing)

Coolimg method ..... Forced air cooling using fan

Isolation voltage..... ± 250 Vmax

*1: Using optional isolated analog interface (Voltage control, factory option), it can be controlled by the power supply output and the isolated external voltage.
*2: Using optional isolated analog interface (Current control, factory option), it can be controlled with the current 4 mA to 20 mA.
*3: Using optional isolated analog interface (Voltage control/Current control, factory option), the power supply output can be isolated.
*4: J1 connector on the rear panel
*5: Photocoupler open collector output

Dual-Tracking DC Power Supply (CV/CC)

PMR Series * While Supplies Last

GPIB OPTION RS-232C OPTION USB OPTION CE

PMR18-2.5DU PMR35-1.2DU PMR18-1.3TR PMR25-1TR PMR24-1QU

A multi-output system in a simple way with TP-BUS

The PMR Series is a multi-output, constant voltage/constant current regulated DC power supply with a dual-tracking function. It uses a series regulator system to generate stable outputs with low noise. Moreover, it is compatible with various external controls. For GPIB control (in combination with an optionally available PIA4830), it is provided with the TP-BUS that allows a system to be built by simple connections. It can be widely used as a power supply for testing LCDs, PDPs, and other devices.

Dimensions / Weight

142.5(5.61″)W × 124(4.88″)H × 350(13.78″)Dmm / 6.5kg(14.33 lbs)

Computer Control

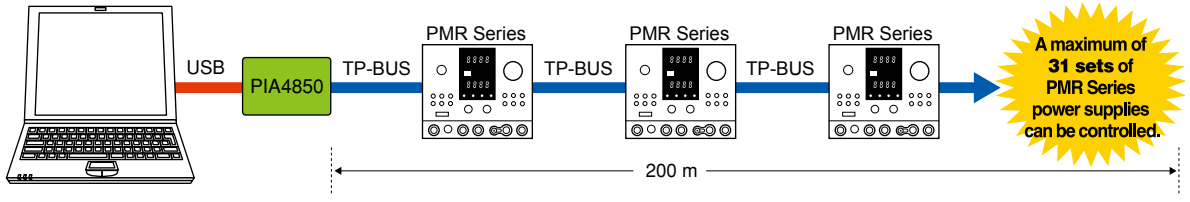
The PMR Series power supplies can be controlled using an optional PIA4800 Series power supply controller. Connecting a PIA4800 Series power supply controller via TP-BUS allows easy remote control at a maximum distance of 200 m. This allows you to control the following:

- ●Setting output voltage/current of each channel
- ●Reading back output voltage/current of each channel
- ●Turning outputs on/off

Features

- ■ Dual-tracking function capable of varying positive and negative voltages simultaneously
- ■ Uncluttered, easy-to-use operation panel
- ■ Preset memory function (three memories) for ease of use and convenience, even in manual operation.
- ■ High-resolution voltage/current display (4-digit display)
- ■ TP-BUS (serial communications), maximum control distance: 200 m
- ■ External analog remote control
- ■ Five models with 2, 3, or 4 outputs

● Example of connection using TP-BUS



*For the details, please refer to page 32 .

PMR Series Specifications

Model		Output		Ripple		Line Regulation		Load Regulation		Power Source	Power Consumption	Weight
		CV	CC	CV	CC	CV	CC	CV	CC	AC	Approx.	Approx.
		V	A	mVrms	mArms	mV	mA	mV	mA	V±10%	VA	kg
PMR18-2.5DU *	**OUTPUT CH1**	0 to +18	0 to +2.5	0.5 or less	1.5 or less	Within ±1	Within ±2	Within ±2	Within ±5	90 V-110 V(1 ϕ) 106 V-125 V(1 ϕ) 180 V-220 V(1 ϕ) 211 V-250 V(1 ϕ) Selectable using the switch at the bottom 50/60 Hz	280	6.5
	OUTPUT CH2	0 to -18	0 to -2.5	0.5 or less	1.5 or less	Within ±1	Within ±2	Within ±2	Within ±5			
PMR35-1.2DU *	**OUTPUT CH1**	0 to +35	0 to +1.2	0.5 or less	1.5 or less	Within ±2	Within ±2	Within ±2	Within ±5			
	OUTPUT CH2	0 to -35	0 to -1.2	0.5 or less	1.5 or less	Within ±2	Within ±2	Within ±2	Within ±5			
PMR18-1.3TR *	**OUTPUT CH1**	0 to +18	0 to +1.3	0.5 or less	1.5 or less	Within ±2	Within ±2	Within ±2	Within ±5			
	OUTPUT CH2	0 to -18	0 to -1.3	0.5 or less	1.5 or less	Within ±2	Within ±2	Within ±2	Within ±5			
	OUTPUT CH3	0 to +6	0 to +5	0.5 or less	4 or less	Within ±2	Within ±4	Within ±5	Within ±10			
PMR25-1TR *	**OUTPUT CH1**	0 to +25	0 to +1	0.5 or less	1.5 or less	Within ±2	Within ±2	Within ±2	Within ±5			
	OUTPUT CH2	0 to -25	0 to -1	0.5 or less	1.5 or less	Within ±2	Within ±2	Within ±2	Within ±5			
	OUTPUT CH3	0 to +6	0 to +5	0.5 or less	4 or less	Within ±2	Within ±4	Within ±5	Within ±10			
PMR24-1QU *	**OUTPUT CH1**	0 to +24	0 to +1	0.5 or less	1.5 or less	Within ±2	Within ±2	Within ±2	Within ±5			
	OUTPUT CH2	0 to -24	0 to -1	0.5 or less	1.5 or less	Within ±2	Within ±2	Within ±2	Within ±5			
	OUTPUT CH3	0 to +12	0 to +1.5	0.5 or less	1.5 or less	Within ±1	Within ±2	Within ±2	Within ±5			
	OUTPUT CH4	0 to -12	0 to -1.5	0.5 or less	1.5 or less	Within ±1	Within ±2	Within ±2	Within ±5			

* While Supplies Last

Unless otherwise specified, the specifications are based on the following conditions:
pure resistive load, measurement at the output terminals, COM grounding (output 3 of PMR-TR is negative grounded), and use of the unit after a 30-minute warm-up.

- Constant-voltage temperature coefficient ..... 100 ppm/°C or less
- Constant-current temperature coefficient ..... 300 ppm/°C or less
- Transient response ..... 50 µs, typical
- Meter indication ..... Four-digit display for both voltage and current, maximum indication: 99.99
- Voltmeter ..... Accuracy:
  ±(0.15 % rdg.+ 20 mV)(OUTPUT CH1, 2, 4 CH3 of PMR24-1QU)
  ±(0.2 % rdg.+ 5 mV)(OUTPUT CH3)
  Resolution:
  10 mV (OUTPUT CH1, 2, 4, CH3 of PMR24-1QU)
  1 mV (OUTPUT CH3)
- Ammeter ..... Accuracy:
  ±(0.3 % rdg.+ 5 mA)(OUTPUT CH1, 2, 4)
  ±(0.3 % rdg.+ 2 mA)(OUTPUT CH1 of PMR24-1QU)
  ±(0.4 % rdg.+ 5 mA)(OUTPUT CH3)
  ±(0.3 % rdg.+ 5 mA)(OUTPUT CH3 of PMR24-1QU)
  Resolution: 1 mA
- Protective circuits ..... Output fuse: provided for each output
  Input fuse: 4 A, 250 V
  Thermal fuse: 126 °C
  (inside the power transformer) Thermal cutout: 95 °C
  (on pass-transistor heat sink)
- Output ON/OFF ..... All outputs are turned ON/OFF Simultaneously.
- Tracking control Outputs 1 and 2
- Tracking operation ON/OFF ..... Operable
- Memory function ..... Three memories
  (for storing setup voltage and current values of all outputs)
- Lock function ..... The front panel switches and dial,or the dial function is inactivated.
- OHP alarm signal output .... Output with a photocoupler
- Grounding..... Positive, COM, or negative grounding possible.
- Common ..... Common to all output
  (Note that output 3 of the PMR-TR type is independent.)
- Isolation Voltage to ground... ± 250 VDC
- Insulation resistance ..... Between the primary input and the chassis 30 MΩ or more at 500 VDC
  Between the primary input and each output 30 MΩ or more at 500 VDC
  Between each output and the chassis 20 MΩ or more at 500 VDC
- Withstand voltage ..... Between the primary input and the chassis 1.5 kV AC,No abnormality for one minute Between the primary input and each output 1.5 kV AC, No abnormality for one minute
- EMC
  (Complied with the following standards)
  IEC61326-1:1997-03 / A1:1998-05 .... Electrical Equipment for Measurement, Control and Laboratory Use - EMC requirements
  Radiated Emissions..... Class A
  Conducted Emissions..... Class A
  IEC61000-4-2:1995-01/A1:1998-01 ... Electrostatic discharge
  IEC61000-4-3:1995-02 ... Radiated, radio-frequency, electromagnetic field
  IEC61000-4-4:1995-01 ... Electrical fast transient/Burst
  IEC61000-4-5:1995-02 ... Surge
  IEC61000-4-6:1996-04 ... Conducted disturbances
  IEC61000-4-11:1994-06 ... Voltage dips, short interruptions and voltage variations
- Safety
  (Complied with the following standards)
  IEC61010-1:1990-09 / A2:1995-07 .... Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use PMR is designed so that it is connected to a power supply of overvoltage category I and II as Class I equipment in environment of pollution degree 2.
- Operating ambient temperature/humidity ..... 0 to +40 °C, 10 to 80 % R.H. (no condensation)
- Cooling system..... Forced air cooling
- Dimensions..... 142.5 W × 124 (160) H × 350 (380) D mm

High Reliability DC Power Supply (CV/CC)

PAN-A Series

GPIB OPTION RS-232C OPTION CE

TYPE 0 (175 W)

TYPE I_2 (350 W) TYPE I_3 (700 W)

Basic DC Power Supplies Superior for General Purpose Use.

The PAN-A Series is a high-performance, highly reliable DC power supply unit featuring regulated variable voltage. These units are suitable for use in a range of fields including research and development, quality control, and production. The PAN-A Series consists of a pre-regulator using FETs and a series regulator using power transistors, providing the high-quality output characteristic of the latter as well as the low power-source harmonic distortion of choke input type phase control. To achieve the high reliability and safety, components of sufficient derating and long-proven mounting techniques are used throughout. All models are carefully designed and furnished with over voltage protection (OVP) and various safety functions.

Dimensions

Type 0 :106(4.17″)W × 140(5.51″)H × 400(15.75″)Dmm
Type I_2 :210(8.27″)W × 140(5.51″)H × 350(13.78″)Dmm
Type I_3 :210(8.27″)W × 140(5.51″)H × 400(15.75″)Dmm

Features

- Low temperature drift
- Quick transient response
- Low ripple noise voltage
- Various safety functions
- External analog control
- GPIB control (optional function)

Quick Transient Response

Since the Error Amplifier has a characteristics of wide frequency bandwidth, stable gain, less phase shift and high loop gain, the PAN-A series is equipped with a highly stable and low output impedance as well as quick response to sudden change of the load. (Typical response time is 50 μs)

Low Temperature Drift

Carefully selected components, improved circuit design, and heat dissipation based on the forced air cooling design have achieved a low-temperature drift of 100 ppm/°C (constant voltage characteristic) and 300 ppm/°C (constant current characteristic).

Application

Incorporates a wide range of functions capable of systematization, including analog signal- or computer- (GPIB) based remote control, remote sensing, and master-slave-control serial and parallel operations.

PAN-A Series Specifications

Model	Output		Ripple		Line regulation		Load regulation		Size	Weight	Input	
	CV	CC	CV	CC	CV	CC	CV	CC	Type	Approx.	Voltage	Power consunption
	V	A	mVrms	mArms	0.005 %+mV	mA	0.005 %+mV	mA		kg	V	Approx.kVA
PAN 16-10A	0 to 16	0 to 10	0.5	2	1	1	1	3	0	11	230	0.4
PAN 16-18A		0 to 18	0.5	5	1	1	1	3	I2	17	230	0.8
PAN 16-30A		0 to 30	0.5	5	1	3	2	3	I3	23	230	1.1
PAN 35-5A	0 to 35	0 to 5	0.5	1	1	1	1	2	0	11	230	0.4
PAN 35-10A		0 to 10	0.5	2	1	1	1	3	I2	17	230	0.8
PAN 35-20A		0 to 20	0.5	3	1	3	2	3	I3	23	230	1.4
PAN 60-3A	0 to 60	0 to 3	0.5	1	1	1	1	2	0	11	230	0.35
PAN 60-6A		0 to 6	0.5	2	1	1	1	3	I2	17	230	0.7
PAN 60-10A		0 to 10	0.5	3	1	3	1	3	I3	22	230	1.1

■ Constant voltage temperature coefficient ..... 100 p.p.m./°C (standard value)

■ Constant current temperature coefficient ..... 300 p.p.m./°C (standard value)

■ Transient response time ..... 50 μs: Time required for the output voltage to return to a value less than 0.05 % of the rated value + 10 mV, against a fluctuation of 5 % to 100 % of the output current.

■ Ripple noise ..... Using an AC voltmeter having a range of 5 Hz to 1 MHz, ± 3 dB, indicated in mean value and effective value measurement is performed with either a positive or negative output terminal connected to the ground.

■ Indication meters

Voltmeter indication error ..... ±(0.5 % rdg + 2 digits) at 23 °C ± 5°C

Voltmeter max. indication digits ..... 199.9 (Note: 19.99 for the PAN16-10A/PAN16-18A/PAN16-30A models.)

Amperemeter indication error ..... ±(1 % rdg + 5 digits) at 23 °C ± 5°C

Amperemeter max. indication digits ..... 19.99 (Note: 199.9 for the PAN16-30A/PAN35-20A)

Grounding ..... Either the positive or negative terminal can be grounded.

Isolation voltage to ground ..... ±250 VDC

■ Insulation resistance ..... Across input side and chassis: Greater than 30 MΩ at 500 VDC
Across output side and chassis: Greater than 20 MΩ at 500 VDC

■ Withstand voltage ..... Nothing abnormal should occur at 1500 VAC,1 min.

■ Operating temperature ..... 0 to 40°

■ Operating humidity ..... 10 to 90 % RH

■ Cooling system ..... Forced air cooling using a fan

■ Constant voltage operation ..... Green LED

■ Constant current operation ..... Red LED

■ Protection system .....
- Constant voltage/current automatic crossover system
- Overvoltage protector (OVP) (10 % to 110 % of rated output voltage)
- Overcurrent protection circuit (Approx. 110 % of rated output current)
- Overvoltage protection circuit (Smoothing electrolytic capacitor for the rectification circuit)
- Overheat protection circuit (OHP) (Semiconductor cooling heat-sink [100 °C])
- Thermal fuse (Main- or sub-transformer)
- Input/output fuse

Programmable Bipolar Power Supply (CV/CC)

PBZ Series

GPIB USB RS-232C LAN OPTION DRIVERS CE LXI

Superior output characteristic by adopting the Power Amp System

The PBZ series is a bipolar type DC regulated power source that can continuously change both positive and negative polarities passing through 0 without changing the output terminal.
By adopting a "Switching + Linear" system, the PBZ is able to realize 40 % lighter than PBX series while achieving high speed operation with low ripple noise. Since operation covers 4 quadrants, power can be both supplied (source) and absorbed (sink). The PBZ can also drive inductive or capacitive loads. The unit also equips a signal generator function which enables waveform and sequence creation. The PBZ is also capable of synchronized operation which is required for voltage variation tests, and it can also be expanded for large current applications through master-slave parallel operation.

Dimensions / Weight

429.5(16.91″)W × 128(5.0″)H × 550(21.65″)Dmm / 22kg(48.5 lbs)

Accessories

Operation manual, Power cord, Cord set, Weight sticker

Features

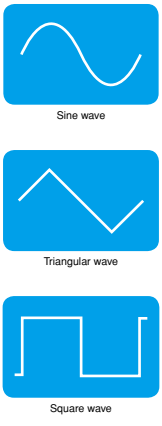
- Waveform generation function
- Low ripple noise
- Synchronized operation function
- Sequence function
- Unipolar mode
- Parallel operation function
- High-speed response 100kHz (CV)

Functions

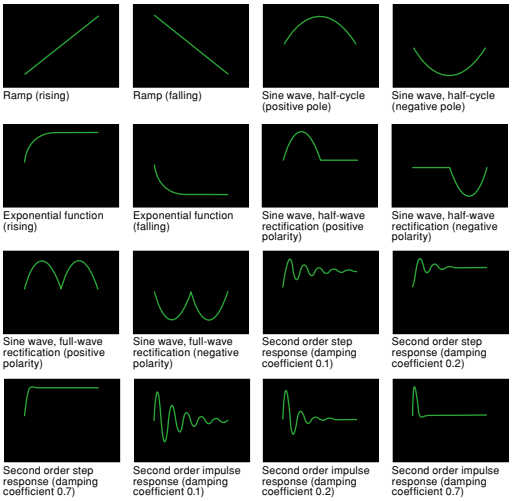
■ Waveform generation function

In addition to the basic sine, square and triangular waveforms, the PBZ series is equipped with a user-defined waveform generating function that can register up to 16 waveforms. It allows the amplitude, frequency, start phase, frequency sweep and square wave duty to be set as needed.
The 16 user-defined waveforms can be freely edited, and the original created and edited waveforms can be registered and easily recalled for use. The sequence function allows each waveform to be set as a single step, and a maximum of 1024 steps can be set in the 16 programs.

● 3 basic waveforms



● 16 user-defined waveforms (The waveforms below are registered as defaults.)



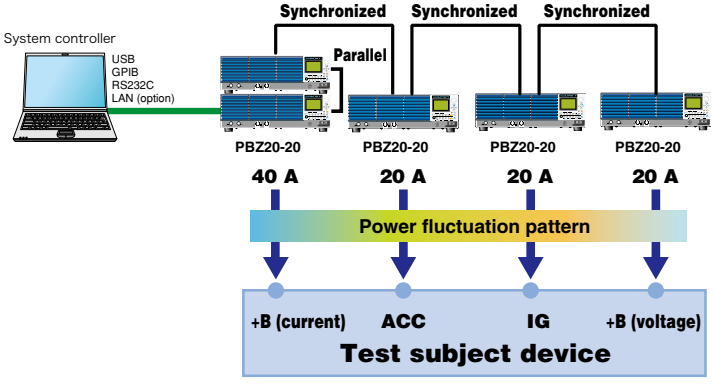
■ Low ripple and noise (in CV mode)

For the Ripple 2 mVrms, Noise 20 mVp-p (PBZ20-20)

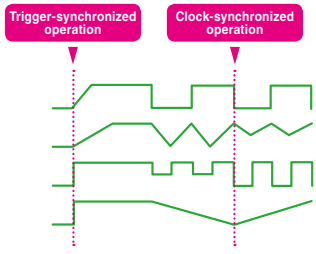
■ Synchronized operation function

This function synchronizes the power output when a sequence is executed using multiple PBZ. It prevents time deviations from occurring even when a long sequence is executed. *A delay of up to 1μs occurs at the start.

●Sample configuration of a voltage fluctuation test system



●Example of combined trigger- and clock-synchronized operation



Functions

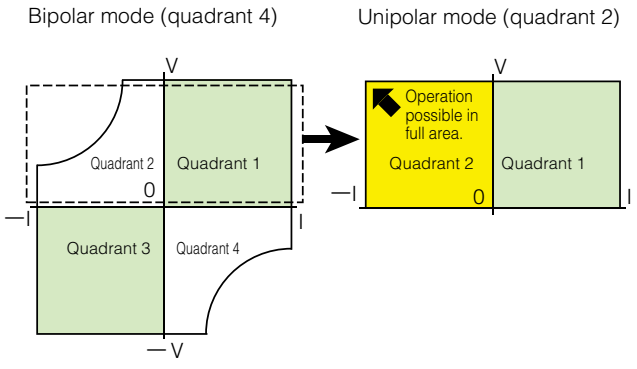
■ Sequence function

The basic sine, triangular and square waveforms, as well as the 16 user-defined waveforms, can each be set as a sequence step, allowing even complex sequences to be created easily. Sequences are composed of up to 1024 steps. This combination of steps forms a program, and the 1024 steps can be allocated and set in a maximum of 16 programs. When executing sequences, in addition to executing a single program, the script function also allows multiple programs to be combined and executed as needed.

A script is a function that specifies the sequence and number of repetitions for the set programs. A maximum of 50 lines can be set in 1 script for each CV and CC mode.

■ Unipolar mode

This is a function unique to this product. Because the voltage is unipolar, this function is called “unipolar mode”. With unipolar power, although the current flows in a single direction, in unipolar mode it is still possible to apply current in both directions (source and sink). As shown in the diagram, on a graph with perpendicular axes of voltage (vertical) and current (horizontal), operation is possible in quadrant 1 and quadrant 2 (2 quadrants). In bipolar mode, there are power restriction areas (PBZ20-20: 100 W, PBZ40-10: 180 W) in quadrants 2 and 4. However in unipolar mode, operation is possible in the full area of quadrant 2.

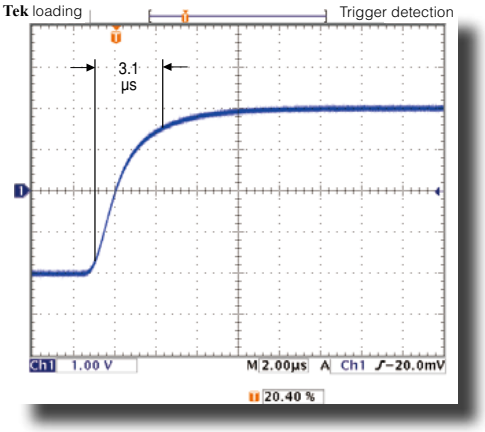


■ Parallel operation function

This function expands the output current. It allows multiple units to be connected in parallel according to the required current. With 2 units of the same model and the optional parallel operation kit, the user can easily complete the setup. Although up to 5 units can be operated in parallel, if 3 or more units will be used, please consult with us.

■ High-speed response 100 kHz (CV)

The superior waveform quality with rise and fall with times of 3.5 µs which makes it possible to reproduce a variety of waveforms with high precision.



▲ Sample of rising waveform
When response of 3.5 µs is set

Options

■ Vertical stand
VS01

■ Parallel operation kit
PK01-PBZ
PK02-PBZ
PK03-PBZ

■ Interface Board
LAN Interface **factory option**

It applies to control and monitor the power supply from a browser.

■ Sequence Creation Software
Wavy for PBZ

■ Switch Box
OT01-PBZ

■ Application Software
SD014-PBZ

PBZ Series Specifications

Unless specified otherwise, the specifications are for the following settings and conditions.
- The warm-up time is 30 minutes (with current flowing).
- TYP value: These are typical values that are representative of situations where the PBZ operates in an environment with an ambient temperature of 23 ºC. These values do not guarantee the performance of the PBZ.
- rating/CF: The rated voltage or rated current divided by CF (crest factor).
- The polarity of the output voltage and current is defined as follows.
  Voltage: Using the output's COM terminal as a reference, the voltage is positive (+) when the OUT terminal is positive and negative (-) when the OUT terminal is negative.
  Current: Positive (+) when current flows out from the OUT terminal and negative (-) when current flows into the OUT terminal.
- The output specifications apply to the rear panel output terminals under the following conditions:
  The short bar is used to connect the output's COM terminal and chassis terminal.
  Remote sensing is not being performed.
  The auxiliary output terminals may not meet the specifications.
- Loads are purely resistive loads.
- Rated loads are defined as follows:
  When the PBZ is generating its rated voltage, the load causes the rated current to flow.
  Or, when the PBZ is generating its rated current, the load makes the voltage drop to the PBZ's rated voltage.

AC input, rated output		PBZ20-20	PBZ40-10
AC input	Nominal input voltage	100 V to 240 V AC, 50/60 Hz	
	Voltage and frequency range	90 V to 250 V AC, 47 Hz to 63 Hz	
	Current	10 A AC or less (at rated load)	
	Inrush current	40 Apeak or less	
	Power	900 VA or less (at rated load)	
	Power factor	0.95 (at input voltage 100 V, rated load) (TYP value)	
Rated output	Output power	400 W	
	Output voltage	±20 V	±40 V
	Output current	±20 A	±10 A
	Voltage to ground	DC 500 V, grounding permitted at COM terminal only	

Constant voltage (CV mode)			PBZ20-20	PBZ40-10
DC voltage	Setting range *1	Bipolar mode	0.000 V to ±21.000 V	0.000 V to ±42.000 V
		Unipolar mode	0.000 V to 21.000 V	0.000 V to 42.000 V
		Fine function	±5 % of rating	
	Setting resolution		0.001 V (Fine function setting resolution 0.0001 V)	
	Setting accuracy *2		±(0.05 % of setting + 0.05 % of rating)	
	Temp. coefficient		±(100 ppm/°C of rating) (TYP value)	
AC voltage	Setting range *1		0.0 Vpp to 42.0 Vpp	0.0 Vpp to 84.0 Vpp
	Setting resolution		0.1 V	
	Setting accuracy *3		±0.5 % of rating	
AC frequency	Setting range		0.01 Hz to 100.00 kHz	
	Setting resolution		0.01 Hz	
	Setting accuracy		±200 ppm	
	Sweep		Linear, log	
	Sweep time		100 µs to 1000 s (resolution 100 µs)	
AC waveform	Type		Sine wave, square wave, triangular wave, user-defined waves (16 waves)	
	Start phase		0 ° to 359 °	
	Square wave duty		0.1 % to 99.9 % (f < 100 Hz), 1 % to 99 % (100 Hz ≤ f < 1 kHz) 10 % to 90 % (1 kHz ≤ f < 10 kHz), 50 % fixed (10 kHz ≤ f)	
Constant voltage characteristic	Frequency characteristic *4		DC to 100 kHz (TYP value)	
	Response *5 *6		3.5 µs, 10 µs, 35 µs, 100 µs (TYP value)	
	Overshoot		5 % or less (TYP value)	
	Ripple Noise	(p-p) *7	20 mV (TYP value)	
		(rms) *8	2 mV (TYP value)	4 mV (TYP value)
	Load effect *9		±(0.005 % of setting + 1 mV)	
	Source effect *10		±(0.005 % of setting + 1 mV)	

*1 The combination of the DC voltage and AC voltage peak values is limited to within the DC voltage setting range.
*2 At ambient temperature of 18 °C to 28 °C
*3 At ambient temp. 18 °C to 28 °C, 1 kHz sine wave, response 3.5 µs, no load
*4 Frequency at which the amplitude ratio of the output voltage relative to the external signal input voltage is -3 dB (at standard frequency 1 kHz, response 3.5 µs, rated load)
*5 Rise time/fall time (at rated load, excepting output ON/OFF) Frequency characteristic determined by the set response (frequency band = 0.35/Rise time).
*6 Rise time: When the output voltage is changed from 0V to the rated voltage, the rise time is the time during which output voltage changes from 10 % to 90 % of the rated voltage.
Fall time: When the output voltage is changed from the rated voltage to 0 V, the fall time is the time during which output voltage changes from 90 % to 10 % of the rated voltage.
*7 Measurement frequency band is 10 Hz to 20 MHz (at the output terminal).
*8 Measurement frequency band is 10 Hz to 1 MHz (at the output terminal).
*9 Change in output voltage (at sensing terminal using remote sensing) in response to a change from 0 % to 100 % of the rated output current
*10 Change in output voltage (at sensing terminal using remote sensing) in response to a ±10 % change from the nominal input voltage

Constant current (CC mode)			PBZ20-20	PBZ40-10
DC current	Setting range *1	Bipolar mode	0.000 A to ±21.000 A	0.000 A to ±10.500 A
		Unipolar mode		
		Fine function	±5 % of rating	
	Setting resolution		0.001 A (Fine function setting resolution 0.0001 A)	
	Setting accuracy *2		±(0.3 % of rating)	
	Temp. coefficient		±(100 ppm/°C of rating) (TYP value)	
AC current	Setting range *1		0.0 App to 42.0 App	0.0 App to 21.0 App
	Setting resolution		0.1 A	
	Setting accuracy *3		±(0.5 % of rating)	
AC frequency	Setting range		0.01 Hz to 100.00 kHz	
	Setting resolution		0.01 Hz	
	Setting accuracy		±200 ppm	
	Sweep		Linear, log	
	Sweep time		100 µs to 1000 s (resolution 100 µs)	
AC waveform	Type		Sine wave, square wave, triangular wave, user-defined waves (16 waves)	
	Start phase		0 ° to 359 °	
	Square wave duty		0.1 % to 99.0 % (f < 100 Hz), 1 % to 99 % (100 Hz ≤ f < 1 kHz) 10 % to 90 % (1 kHz ≤ f < 10 kHz), 50 % fixed (10 kHz ≤ f)	
Constant current characteristic	Frequency characteristic *4		DC to 10 kHz (TYP value)	DC to 5 kHz (TYP value)
	Response		35 µs, 100 µs, 350 µs, 1 ms (TYP value)	70 µs, 100 µs, 350 µs, 1 ms (TYP value)
	Overshoot		5% or less (TYP value)	
	Ripple noise (rms) *7		3 mA (TYP value)	
	Load effect *8		±(0.01 % of setting + 1 mA)	
	Source effect *9		±(0.01 % of setting + 1 mA)	

*1 The combination of the DC current and AC current peak values is limited to within the DC current setting range.
*2 At ambient temperature of 18 °C to 28 °C
*3 At ambient temp. 18 °C to 28 °C, 100 Hz sine wave, response 35 µs, output short circuited
*4 Frequency at which the ratio of the external signal input amplitude and output current amplitude is -3 dB (at standard frequency 100 Hz, response 35 µs, rated load)
The frequency characteristic varies depending on the load impedance.When the load impedance increases, the frequency characteristic declines.
*5 Rise time/fall time (at rated load, excepting output ON/OFF) Rise/fall time varies depending on the load impedance.
*6 Rise time: When the output current is changed from 0 A to the rated current, this is the rise time is the time during which the output current changes from 10 % to 90 % of the rated current.
Fall time: When the output current is changed from the rated current to 0 A, the fall time is the time during which the output current changes from 90 % to 10 % of the rated current.
*7 The measurement frequency band is 10 Hz to 1 MHz (at 10 % to 100 % of rated output voltage).
*8 Change in the output current in response to a voltage change from 10 % to 100 % of the rated output voltage
*9 Change in the output current in response to a ±10 % fluctuation from the nominal input voltage (at 10 % to 100 % of the rated output voltage)

PBZ Series Specifications

Measurement display function			PBZ20-20	PBZ40-10
Voltage measurement	DC	Measurement range (resolution)	120 % of rating（0.001 V）	
		Accuracy *1	±(0.05 % of reading + 0.05 % of rating)	
		Temp. coefficient	±(100 ppm/°C of rating) (TYP value)	
	AC	Measurement range (resolution)	120 % of rating/CF (0.001 V)	
	DC + AC	Measurement range (resolution)	120 % of rating（0.001 V）	
	AC, DC + AC	Accuracy *1, *2	±(0.5 % of reading + 0.1 % of rating) (5 Hz to 10 kHz)	
			±(1 % of reading + 0.2 % of rating) (10 kHz to 50 kHz)	
			±(2 % of reading + 0.2 % of rating) (50 kHz to 100 kHz)	
	PEAK	Measurement range (resolution)	120 % of rating (0.01 V)	
	PEAK	Accuracy *1, *3	±(0.5 % of rating)	
Current measurement	DC	Measurement range (resolution)	120 % of rating (0.001 A)	
		Accuracy *1	±(0.3 % of reading + 0.1 % of rating)	
		Temp. coefficient	±(150 ppm/°C of rating) (TYP value)	
	AC	Measurement range (resolution)	120 % of rating/CF (0.001 A)	
	DC + AC	Measurement range (resolution)	120 % of rating (0.001 A)	
	AC, DC + AC	Accuracy *1, *2	±(3 % of reading + 0.1 % of rating) (5 Hz to 10 kHz)	
			±(10 % of reading + 1 % of rating) (10 kHz to 100 kHz)	
	PEAK	Measurement range (resolution)	120 % of rating (0.01 A)	
	PEAK	Accuracy *1, *3	±(0.5 % of rating)	
Measurement time			100 µs to 3600 s	

*1 At ambient temperature of 18 °C to 28 °C
*2 When the input signal is a sine wave with a crest factor of 3 or less within the prescribed frequency range and the measurement time is the no more than 10 times the period of the input signal
*3 Peak value of a 1 kHz sine wave

Protection functions		PBZ20-20	PBZ40-10
Overvoltage protection	Protection trip *1, *2	OVP or V-LIMIT (output restriction) For OVP, select either output OFF or POWER switch OFF.	
	Setting range (Bipolar mode)	-22.0 V to -0.2 V 0.2 V to 22.0 V	-44.0 V to -0.4 V 0.4 V to 44.0 V
	Setting range (Unipolar mode)	0.2 V to 22.0 V	0.4 V to 44.0 V
	Setting resolution	0.1 V	
	Setting accuracy	±1 % of rating	
Overcurrent protection	Protection trip *1, *2	OCP or I-LIMIT (output restriction) For OCP, select either output OFF or POWER switch OFF.	
	Setting range	-22.0 A to -0.2 A 0.2 A to 22.0 A	-11.0 A to -0.1 A 0.1 A to 11.0 A
	Setting resolution	0.1A	
	Setting accuracy	±1 % of rating	
Overheating protection	Protection trip	Output turns OFF when overheating is detected.	
Power restriction (Sink power)	Bipolar mode	100 W (TYP value)	180 W (TYP value)
	Unipolar mode	400 W (TYP value)	400 W (TYP value)
Control functions		PBZ20-20	PBZ40-10
Internal signal source DC signal control	Control voltage input	Approx 0 V to Approx. ±10.0 V, 0 % to ±100 % of rated output	
	Control voltage ratio input	0 % to ±108 % of rated voltage by changing the voltage ratio of the internal standard voltage, using 10 kΩ external resistance	
Output ON/OFF control input		External contact input for output ON/OFF	
Shutdown input		External contact input for POWER switch OFF	
Status output		CV mode, CC mode, output ON, alarm active	

*1 Voltage is detected at the output terminal.
*2 OVP is enabled even when V-LIMIT (voltage restriction) is selected. OVP operation point is approx. ±(120% of rtg).

Signal I/O			PBZ20-20	PBZ40-10
External signal input	Amplifier gain	CV mode	-20 to +20	-40 to +40
		CC mode	-20 S to +20 S	-10 S to +10 S
		Setting resolution	0.1 (CV mode), 0.1 S (CC mode)	
		Setting accuracy *1	±5 % of rating	
	Max. allowable input voltage		±12 Vpeak	
	Input impedance		10 kΩ(TYP value)	
	Terminal		BNC Safety Socket (Common connects to output COM terminal.)	
Current monitor Output	Output voltage		2 V at rated current	
	Output voltage accuracy		±1 % of rating (TYP value)	
	Output voltage frequency characteristic		DC to 20 kHz	
	Terminal		BNC Safety Socket (Common connects to output COM terminal.)	
Clock input	Input voltage		0.5 Vpp to 5 Vpp	
	Input impedance		1 kΩ (AC coupled) (TYP value)	
	Lock frequency range		10 MHz ± 200 Hz	
	Lock time		2 s or less	
	Terminal		Insulated BNC (Common is insulated from chassis: Voltage to ground Max. 42 V peak)	
Clock output	Output voltage		1 Vpp (with 50 Ω terminal) (TYP value)	
	Output impedance		50 Ω (AC coupled) (TYP value)	
	Output frequency		10 MHz ± 200 Hz	
	Terminal		BNC (Common connected to chassis.)	
Trigger input	Input level		H level: 2 V to 5 V, L level: 0 V to 0.8 V (TTL compatible)	
	Polarity		H level, L level	
	Pulse width		1 µs or more	
	Delay		1 µs or less	
	Input impedance		10 kΩ (TYP value) (DC coupled)	
	Terminal		BNC (Common connected to chassis.)	
Trigger output	Output level		H level: 2.7 V to 5 V, L level: 0 V to 0.4 V (TTL compatible)	
	Polarity		H level, L level	
	Pulse width		10 µs (TYP value)	
	Rise/fall time		100 ns or less	
	Fan-out		5 PBZ series units	
	Terminal		BNC (Common connected to chassis.)	

*1 With DC and amplifier gain at maximum

Interface		PBZ20-20	PBZ40-10
Common specifications	Software protocol	IEEEStd 488.2-1992	
	Command language	Conforms to SCPI Specification 1999.0.	
RS232C	Hardware	Conforms to EIA232D specifications. D-SUB 9-pin connector (male) *1 Baud rate: 1200, 2400, 4800, 9600, 19200 38400 bps Data length: 7 bits or 8 bits, Stop bit: 1 bit or 2 bits, No parity Flow control: X-Flow/None	
	Program message terminator	LF when receiving, CR/LF when sending	
GPIB	Hardware	Conforms to IEEEStd 488.2-1987 specifications. SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E1 24-pin connector (receptacle)	
	Program message terminator	LF or EOI when receiving, LF + EOI when sending	
	Primary address	1 to 30	
USB	Hardware	Conforms to USB 2.0 specifications. Communications speed: 12 Mbps (full speed) Socket B type	
	Program message terminator	LF or EOM when receiving, LF + EOM when sending	
	Device class	Conforms to USBTMC-USB488 device class specifications.	
LAN (factory option)	Hardware	IEEE802.3 100Base-TX/10Base-T Ethernet, IPv4, RJ-45 connector *2	
	Communication protocol	VXI-11	
	Program message terminator	LF or END when receiving, LF + END when sending	

*1 For the cable, use a crossing cable (null modem cable).
*2 Use a category 5 straight type.

Other functions		PBZ20-20	PBZ40-10
Sequence function	No. of programs	16	
	No. of steps	Total 1024	
	Step time	100 µs to 1000 H (100 µs step)	
Preset memory		3 memories	
Setup memory		10 memories	
Key lock		Select from 1 of 3 levels.	
Remote sensing		Function ON/OFF, used in CV mode	
Operation setting at power ON		Output ON, start sequence function execution	
Soft start/soft stop		Function ON/OFF Soft start/stop time 0.1 ms to 1000 s	
Parallel operation		Max. 2 units of same model (using optional parallel operation kit)	

General specifications		PBZ20-20	PBZ40-10
Environment	Operating environment	Indoor use, overvoltage category II	
	Operating temp./humidity range	0 to +40 °C/20 to 85 % RH (no condensation)	
	Storage temp./humidity range	-25 to +70 C/Max. 90% RH (no condensation)	
Grounding polarity		Only the output COM terminal can be grounded.	
Voltage to ground		DC 500 V Max.	
Withstand voltage	Between primary side and chassis	1500 V AC, no abnormalities at 1 minute	
	Between primary side and output terminal		
Insulation resistance	Between primary side and chassis	500 V DC, 30 MΩ or more (at humidity 70 % RH or less)	
	Between primary side and output terminal		
	Between output terminal and chassis	500 V DC, 1 MΩ or less	
Ground continuity	Between power cord connector, grounding pin <-> chassis	25 A AC, 0.1 Ω or less	
Cooling method		Forced air cooling by a temperature-sensitive variable-speed fan	
Safety *1		Conforms to the following safety requirement. IEC61010-1 Class I Pollution degree2	
Electromagnetic compatibility (EMC) *1		Conforms to the following safety requirement. IEC61326-1	
External dimensions (largest part)		429.5 W x 128(145) H x 550(595)D mm	
Weight		Approx. 22 kg	
Accessories		Power cord: 1 J1 connector (Socket: 1, Protective covers: 2, Terminals: 30) Heavy object warning label: 1 Instruction manual: 1	

*1 Cannot be used for special-order or modified products.

Power Supply Controller

PIA4800 Series

GPIB RS-232C DRIVERS CE

PIA4810 PIA4820 PIA4830

Dimensions / Weight

PIA4810, PIA4820: 141.9(5.59″)W × 123.4(4.86″)H × 350 (13.78″)Dmm /5kg(11.02 lbs)
PIA4830 : 70.4(2.77″)W × 123.4(4.86″)H × 350(13.78″) Dmm/2kg(4.41 lbs)

Accessories

Instruction Manual, AC power cord, TP-BUS connector, TP-BUS core
PIA4800 Utilities CD (Included for Model PIA4810 and PIA4830)
OP01-PIA: Flat cable, connector kit (2 pcs.), Connector hood cover (2 pcs.)

Supporting Multiple Channels

The PIA4810 is a power supply controller capable of analog and digital control. It is equipped with the GPIB and RS-232C interfaces and 4 slots, which allow 4 each of PIA4800 Series-specific control boards to be installed. A control board is capable of analog control of 2 channels of DC power supplies or electronic loads; a total of 8 channels can be controlled.
Moreover, DC power supplies with a digital remote-control function, such as the Kikusui PWR, PAS and PMR Series, can be directly connected to the PIA4830 via a TP-BUS (twisted pair bus), enabling a system up to 32 channels to be controlled digitally.
PIA4820 is an expansion unit that can be connected to the PIA4810 or PIA4830 via a TP-BUS to provide additional control channels. In the same way as the PIA4810, it allows a maximum of 4 control boards to be installed.
Then it is possible to use up to 3 units of PIA4820 as an expansion that can be connected to the PIA4810 via the TP-BUS, the system is capable of controlling a maximum of 32 channels. Moreover, the combined use of the GPIB and TP-BUS allows the system to control a maximum of 448 channels.
PIA4830 is a power supply controller only for digital control. It is capable of digitally controlling a system up to 32 channels of such Kikusui PWR, PAS, PAM*1 and PMR Series DC power supplies via the TP-BUS.
OP01-PIA and OP02-PIA are control boards designed exclusively for the PIA4810 and PIA4820. A single control board is capable of analog control of 2 channels of DC power supplies or electronic loads. The OP01-PIA is a full-control board with voltage and current setting and read-back functions, while the OP02-PIA4800 has only the voltage and current setting feature.

Options

■ Shunt Unit
SH10
SH50

*SH-10:for Models having output current rating of 2.5 A to 10 A
*SH-50:for Models having output current rating of 12.5 A to 50 A

■ Shielded 26P Flat Cable
SC01-10
SC01-20

*SC01-10: 1 m length/*SC01-20: 2 m length (OP01-PIA and PAN-A compatible)

■ 2-core shielded cable
SC03-PIA/SC04-PIA/SC05-PIA

SC03-PIA SC04-PIA SC05-PIA

SC03-PIA: (OP01-PIA, PMC-A compatible, about 1.0 m/for 14-pin)
SC04-PIA: (OP02-PIA, PMC-A compatible, about 1.0 m)
SC05-PIA: (OP01-PIA, PMC-A compatible, about 1.0 m/for 26-pin)

■ Terminal Unit
TU02-PIA

*TU02-PIA: Compatible Model:PAN-A Series

■ GPIB cables (Available for all models)
408J-101 (about 1.0 m)
408J-102 (about 2.0 m)
408J-104 (about 4.0 m)

Control Description

■ OP01-PIA

Applied Series	PAN-A*3			PMC-A	
Connection Type	PAN-A(1)	PAN-A(2)	PAN-A(3)	PMC-A(1)	PMC-A(2)
Connection Method (Those marked with * are options.)	Flat cable accompanying OP01-PIA or optional flat cable SC01-10/20 *		provided by the user Connector accompanying OP01-PIA	Shielded cable SC05-PIA **4	
Peripheral options	TU02+SH	TU02		SH	
Output Voltage setting	✔	✔	✔	✔	✔
Output Current setting	✔	✔	✔	✔	✔
Output Voltage readback	✔	✔		✔	✔
Output Current readback	✔*1			✔*1	✔*5
Overvoltage protection setting					
Output ON/OFF	✔	✔			
POWER switch OFF					
Remote/Local switching					
Power switch OFF monitoring				✔	✔
C.V mode monitoring	▲*2	▲*2		✔	✔
C.C mode monitoring	▲*2	▲*2		✔	✔
Output ON/OFF monitoring				✔	✔
Overvoltage protection startup monitoring					
Overheat monitoring					
Alarm monitoring	▲*2	▲*2		✔	✔

■ OP02-PIA

Applied Series	PAN-A	PMC-A
Connection	PAN-A(4)	PMC-A(3)
Connection Method	Twisted wire (provided by the user)	Option SC04-PIA
Output voltage setting	✔	✔
Output current setting	✔	✔
Output ON/OFF	✔	✔

✔ :controllable
No mark: not controllable
▲ : controllable under certain conditions

*1 : Linearity 0.3 % of FS
*2 : A DIN connector is required (Some types are not supported). (Available as factory option)
*3 : OP01-PIA cannot control models with a rated output voltage exceeding 500 V.
*4 : In regard to the previous models (14-pin connector), please use SC03-PIA. In this case, Only 2 items, “Output voltage setting” and “Output current setting,” can be controlled. (However, “Output current readback” is also possible when using peripheral option SH.)
*5 : Linearity 5 % of FS

■ For Digital Control via TP-BUS Connection

Applied Series	PWR/PAS	PMR
Output voltage setting	✔	✔
Output current setting	✔	✔
Queries the output voltage value	✔	
Queries the output current value	✔	
Output voltage readback	✔	✔
Output current readback	✔	✔
Designation / Queries of output channel number		✔
Designation of output channel number to be displayed		✔
Overvoltage protection startup monitoring setting	✔	
Queries the overvoltage protection startup monitoring	✔	
Overcurrent protection startup monitoring setting	✔	
Queries the overcurrent protection startup monitoring	✔	
Output ON/OFF	✔	✔
Queries the output ON/OFF	✔	
Power switch OFF	✔	
Panel Lock ON/OFF	✔	✔

■ Control Board

OP01-PIA

OP02-PIA

Power Supply Controller

PIA4850

USB DRIVERS CE

Dimensions / Weight

95(3.74″)W × 18(0.71″)H × 58(2.28″)Dmm / 100g(0.22 lbs)

Accessories

CD (instruction manual, driver files, sample programs, etc.), Magnet sheet for fastening the base,TP-BUS connector, TP-BUS cable (1 m),USB cable (1 m)

Control Description

✔: Controllable

DC Power Supply Series	PAS	PWR	PMR
Output voltage setting	✔	✔	✔
Output current setting	✔	✔	✔
Query for output voltage setting value	✔	✔	
Query for output current setting value	✔	✔	
Output voltage value read-back	✔	✔	✔
Output current value read-back	✔	✔	✔
Designation/Query of output channel number			✔
Designation of output channel number to display			✔
Overvoltage protection activation point setting	✔	✔	
Query for overvoltage protection activation point	✔	✔	
Overcurrent protection activation point setting	✔	✔	
Query for overcurrent protection activation point	✔	✔	
Output ON/OFF	✔	✔	✔
Power switch shutoff	✔	✔	
Panel lock ON/OFF	✔	✔	✔

Required Drivers and Components

		WAVY application software	VB, VBA, VC++ LabVIEW
VISA (including USB-TMC driver)		Required	Required
PIA4800 instrument driver	IVI-COM/C	Not required	Required in some cases
	IVI Shared Components		

● The latest drivers available at the Kikusui website.

Digital control of DC power by USB!

The PIA4850 is a power supply controller with USB interface to control Kikusui DC power supply with TP-BUS.
PAS Series, PWR Series or other models that equips TP-BUS can be digitaly controled by PC, as well as for read-back of output values and status monitoring. It operates using bus power and with its simple system and compact structure, you can use whenever you need with easy setup.

Features

- USB 2.0 compatible
- Can be used with Windows Vista/XP/2000.
- Operates using bus power. Requires no AC adapter.
- Bus power operation. No AC adapter required.
- Allows read-back of output values and status monitoring.
- Can control up to 32*1 DC power supplies that equip TP-BUS*2. (Different power supply models can be combined.) TP-BUS connection can be extended up to 200 m. Ideal for remote monitoring!

*1 The maximum controlable units are 31 when the connections include PMR series unit.
*2 TP-BUS (Twist-Pair BUS) is an original Kikusui interface.

Includes a magnet sheet to hold the device in place. Can be attached directly to the power supply.

The TP-BUS utilizes a daisy-chain connection. This makes adding power supplies easy and keeps cables neatly together.

Specifications

Item	Details	
TP-BUS	Connections	The connections given below are possible using the provided TP-BUS connector Expansion unit PIA4820: 4 units can be connected (Extension length: Maximum 200 m, Twist count: 1 time/cm or more)
	Number of controlled units*1	PAS Series : Maximum 32 units PWR Series: Maximum 32 units PMR Series: Maximum 31 units
	Polarity	None
	Conforming power wiring	Twisted wire: 0.32 mm² (AWG22) Extended length: Maximum 200 m 0.20 mm² (AWG24) Extended length: Maximum 20 m
USB		Conforms to USB 2.0 specifications, and to USBTMC-USB488 device class specifications. Communications speed: 12 Mbps (full speed) (High power device (power consumption: 200 mA)
OS		Windows2000 Professional (SP4 or later) Windows XP Professional (SP2 or later, 32-bit versions) Vista Home Premium, Business, Ultimate (32-bit versions)
VISA specifications		Ver. 3.0 or higher
Operating ambient temperature/Humidity range		0 °C to 40 °C, 10 % rh – 90 % rh (No condensation.)
Storage ambient temperature/ Humidity range		-20 °C to 70 °C, 10 % rh – 90 % rh (No condensation.)
Installation location		Indoors, maximum height 2000 m
Safety		Conforms to Low-Voltage Directive 73/23/EEC, EN61010-1 Class III, Pollution Degree 2.

*1 The maximum controlable units are 31 when the connections include PMR series unit.

High-performance multifunctional AC Power Supplies

PCR-LE Series

LAN OPTION USB OPTION GPIB OPTION RS-232C CE

LXI

NEW

New stage of AC power supply supporting new energy field

The PCR-LE Series is a new line of advanced multifunctional AC power supply that has been developed from our PCR-L/LA Series (linear amplifier type).
The PCR-LE Series provides high reliability and can be applied to various applications, by taking advantage of the features that can control broadband waveform freely. Moreover, the PCR-LE Series can be configured as a core device of a test system combined with E-loads and Power Analyzers for "Grid Connection Testing" in regard to dispersed power generation, such as Solar Power, Wind Power, Fuel Cell, and Gas Engine referred to as "New Energy Field". With various options, the low frequency immunity test and various power environment tests are supported. The options for parallel operation and three-phase operation enable you to expand a single-phase system up to 27 kVA, single-phase three wires system up to 54 kVA, and a three-phase system up to 81 kVA. The system can be applied to a large-scale EMC site for testing of industrial high-capacity air conditioners.

Dimensions / Weight

PCR500LE : 430(16.93″)W X 173(6.81″)H X 550(21.65″)Dmm / 17kg(37.48 lbs)
PCR1000LE: 430(16.93″)W X 262(10.31″)H X 550(21.65″)Dmm / 35kg(77.16 lbs)
PCR2000LE: 430(16.93″)W X 389(15.31″)H X 550(21.65″)Dmm / 55kg(121.25 lbs)
PCR3000LE: 430(16.93″)W X 690(27.17″)H X 550(21.65″)Dmm / 82kg(180.78 lbs)
PCR4000LE: 430(16.93″)W X 690(27.17″)H X 550(21.65″)Dmm / 96kg(211.64 lbs)
PCR6000LE: 430(16.93″)W X 944(37.17″)H X 550(21.65″)Dmm/140kg(308.65 lbs)
PCR9000LE: 430(16.93″)W X 1325(52.17″)H X 550(21.65″)Dmm /190kg(418.88 lbs)

Accessories

PCR500LE: Operation Manual, Power cord (with 3 m plug)
Other: Operation Manual, Weight seal

[NOTICE] To users of the PCR-L/LA Series

The PCR-LE Series is not compatible with the previous product, the PCR-L/LA Series. Consequently, it is not possible to upgrade a system if it includes a prior PCR-L/LA Series in the system. Further, along with this, in principle options cannot be used, with some exceptions. Please be considered of this notice for your planning of future system. If you have any other questions, please contact our sales department for details.

Features

- High-quality/high-stability output with a high-speed linear amp
- Capable of various power line abnormality simulations and the sequence operation
- Single phase 500 VA to 9 kVA, supporting the system for the single-phase, and expandable with optional drivers for the single-phase three-wire, and three-phase operation
- Expandable capacity up to 27 kVA (single-phase), 54 kVA (single-phase three-wires), and 81 kVA (three-phase)
- Equipped with various measuring functions
- Features a full range of measuring functions and supports AC, DC, and AC + DC Outputs
- Detachable front panel
- Eco-friendly function equipped

Functions

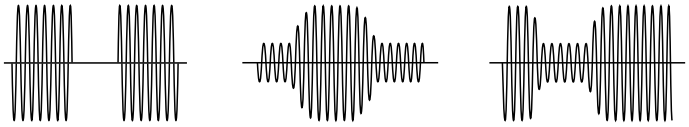
● Wide-ranging specs DC output also supported

Output voltage rating (AC)	1 to 300 V
Output frequency rating	1 to 999.9 Hz
Output voltage rating (DC)	± 1.4 to ± 424 V

In addition, the system supports a DC output mode and AC + DC output mode. The system can be useful in a wider range of fields such as chemistry- and physics-related areas.

● Power line abnormality simulation

In AC mode, it is possible to simulate power line abnormalities by setting the output of the PCR-LE series system to the state of a power outage, voltage drop (dip), or voltage increase (pop). This allows the ability to test switching power supplies and electronic equipment.



power outage　voltage increase (pop)　voltage drop (dip)

● Selectable response mode

Allows select of a response mode for the internal amplifier system depending on the load condition and application.

High-speed response (FAST)*	for requesting a rate of power rise/fall
Normal response (MEDIUM)	for testing various power supply environments
Highly stable response (SLOW)	for power supply for EMC testing sites

*Excluding PCR6000LE, PCR9000LE, three phase operation, single phase 3-wire operation and parallel operation

● Various measuring functions

Output voltage/current RMS values, peak voltage/current, effective power/apparent power, and power factor can be measured.
It is possible to analyze harmonics (up to 40 th order) of the output current.

Options

■ Interface
IB05-PCR-LE (GPIB)
US05-PCR-LE (USB)
LN05-PCR-LE (LAN)
EX05-PCR-LE (Analog)*1 *2
EX06-PCR-LE (Analog)*1 *3

■ Input power cable
AC5.5-3P3M-M4C
AC8-1P3M-M5C-3S
AC14-1P3M-M8C-3S
AC22-1P3M-M8C-3S
AC14-1P3M-M5C-4S

■ Parallel Operation Driver*4
PD05M-PCR-LE*1
(for master unit operated in parallel)
PD05S-PCR-LE*1
(for slave unit operated in parallel)

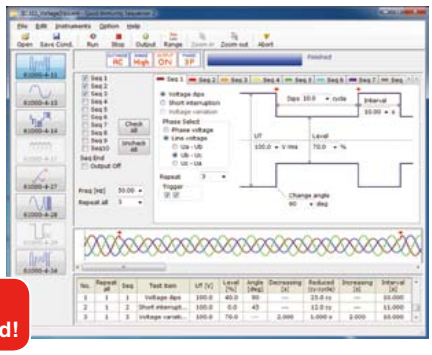
■ Immunity tester*1

■ Line impedance network*1

■ Sequence Creation Software
Wavy for PCR-LE

■ Quick Immunity Sequencer
SD009-PCR-LE

"Quick Immunity Sequencer 2" (model name: SD009-PCR-LE) is an application software for immunity testing with the AC power supply PCR-LE series system, based on the power line disturbance standard (IEC61000-4 Series) for the immunity testing of the EMC standard.
Not only can it be used for compliance testing based on the latest standards or for some types of preliminary testing, but the software can be also employed for advance checking in development phases and for immunity margin tests, because it allows extended testing conditions to be set as needed.



The latest standards for IEC61000-4 supported!

■ Single-phase, Three-wire Driver
2P05-PCR-LE

■ Three-phase Driver
3P05-PCR-LE
3P05-PCR-LE (500 Hz LMT)

■ Connecting cable
CC01-PCR-LE (150 cm)
CC02-PCR-LE (280 cm)

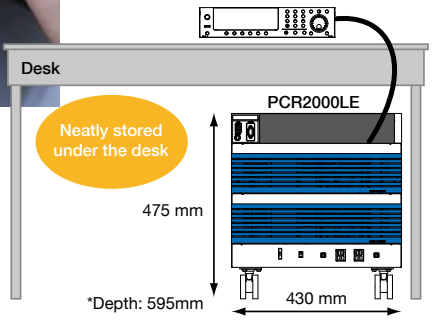
■ Power Linkage Cable 1M
LC01-PCR-LE

■ Extension cable for control panel (2 m)
EC05-PCR

● Front panel serving as a remote control

The front panel is detachable. With the optional extension cable, the panel functions as a remote control.
You can operate the PCR-LE unit installed under your work desk/work bench remotely from the front panel connected with the optional extension cable (EC05-PCR).

[Practical example]



*1 Coming soon
*2 The input waveform is directly amplified and output.
*3 The voltage of the output alternating current can be changed based on the level input DC signal.
*4 PCR500LE and PCR1000LE can not be operated in parallel.

PCR-LE Series Specifications

Item/Model		PCR500LE	PCR1000LE	PCR2000LE	PCR3000LE	PCR4000LE	PCR6000LE	PCR9000LE
Input ratings (AC rms)								
Voltage		85 Vac to 132 Vac, 170 Vac to 250 Vac *1					170 Vac to 250 Vac	
Phases		Single phase						Three phase
Frequency		47 Hz to 63 Hz						
Apparent power		Approx. 0.93 kVA	Approx. 1.8 kVA	Approx. 3.6 kVA	Approx. 5.5 kVA	Approx. 7.3 kVA	Approx. 10.6 kVA	Approx. 15.7 kVA
Power factor *2		0.97 (TYP)						
Max. current *1		11.3 A, 5.5 A	22 A, 10.8 A	44 A, 21.5 A	66 A, 32 A	88 A, 43 A	64 A	55 A
AC mode output ratings (AC rms)								
Voltage (output L range, output H range)		1 V to 150 V, 2 V to 300 V						
	Resolution	0.1 V						
Voltage setting accuracy (output L range, output H range) *3		± (0.3 % of set + 0.6 V)						
Max. current (output L range, output H range) *4		5 A, 2.5 A	10 A, 5 A	20 A, 10 A	30 A, 15 A	40 A, 20 A	60 A, 30 A	90 A, 45 A
Phase		Single phase						
Power capacity		500 VA	1 kVA	2 kVA	3 kVA	4 kVA	6 kVA	9 kVA
Maximum peak current *5		Max. current (rms) × 4 (TYP)						
Max. reverse current *6		30 % of the max. current (rms)						
Load power factor		0 to 1 (leading or lagging) *4						
Frequency *4		1 Hz to 999.9 Hz						
	Resolution	0.01 Hz (1.00 Hz to 100.0 Hz), 0.1 Hz (100.0 Hz to 999.9 Hz)						
DC mode output ratings								
Voltage (output L range, output H range)		1.4 V to 212 V, 2.8 V to 424 V						
	Resolution	0.1 V						
Voltage setting accuracy (output L range, output H range) *7		± (0.05 % of set + 0.05 V), ± (0.05 % of set + 0.1 V)						
Max. current *8		3.5 A, 1.75 A	7 A, 3.5 A	14 A, 7 A	21 A, 10.5 A	28 A, 14 A	42 A, 21 A	63 A, 31.5 A
Max. instantaneous current *9		Max. current (rms) × 3.6						
Power capacity		350 W	700 W	1.4 kW	2.1 kW	2.8 kW	4.2 kW	6.3 kW
Output voltage stability								
Line regulation *10		Within ±0.1 %						
Load regulation (output L range, output H range) *11		Within ±0.1 V, within ±0.2 V						
Output frequency variation *12	FAST	Within ±0.2 %					–	
	MEDIUM	Within ±0.3 %						
Ripple noise in DC mode (5 Hz to 1 MHz components)		0.15 Vrms or less	0.15 Vrms or less	0.15 Vrms or less	0.2 Vrms or less	0.2 Vrms or less	0.25 Vrms or less	0.25 Vrms or less
Ambient temperature variation *13		100 ppm/°C (TYP)						
Output frequency stability, output voltage waveform distortion ratio, output voltage response speed, efficiency								
Output frequency stability *14		Within ±5×10^{-5}						
	Setting accuracy	±1×10^{-4}						
Output voltage waveform distortion ratio *15	FAST	±0.2 % or less					–	
	MEDIUM	±0.3 % or less						
Output voltage response speed *16	FAST	20 µs (TYP)					–	
	MEDIUM	30 µs (TYP)						
Efficiency *17		54 % or more, 56 % or more	55 % or more, 57 % or more				58 % or more	
Meters (fluorescent display)								
Voltmeter *18	Resolution	0.1V						
	Accuracy	± (1 % of rdng + 2 digits)						
Ammeter *18	Resolution	0.01 A	0.01 A	0.01 A	0.1 A	0.1 A	0.1 A	0.1 A
	Accuracy	± (1 % of rdng + 2 digits)						
Wattmeter *19	Resolution	0.1 W, 1 W			1 W			
	Accuracy	± (1 % of rdng + 3 digits)						
Frequency meter	Resolution	0.01 Hz (1.00 Hz to 99.99 Hz), 0.1 Hz (100.0 Hz to 999.9 Hz)						
BNC terminals								
SEQ TRIG OUT *20	Pulse width approx. 10 µs, open collector output, pullup at +5 V and approx. 10 kΩ serial resistance approx. 220 Ω, maximum sink current 10 mA, BNC connector							
SEQ STAT OUT *20	Step time output, open collector output, pullup at +5 V and approx. 10 kΩ serial resistance approx. 220 Ω, maximum sink current 10 mA, BNC connector							
SEQ TRIG IN *20	Operating pulse width 10µs or greater, photo-coupler input, driving voltage 5 V, serial resistance approx. 470 Ω, active with 7 mA source, BNC connector							

*1 100 V input type or 200 V input type

*2 When the input voltage is 100 V or 200 V, the output voltage is 100 V or 200 V, the output current is the rated value, the load power factor is 1, and the output frequency is between 40 Hz and 999.9 Hz.

*3 When the output frequency is between 45 Hz and 65 Hz, with no load, and at room temperature.

*4 When the maximum voltage is between 1 V and 100 V (L range) or 2 V and 200 V (H range) and the load power factor is between 0.8 and 1.
When the output voltage is between 100 V and 150 V (L range) or 200 V and 300 V (H range), the output current is reduced by the output voltage.
When the load power factor is between 0 and 0.8, the output current is reduced by the load power factor.
When the output frequency is between 1 Hz and 40 Hz, the output current is reduced by the output frequency.

*5 For capacitor-input rectifier loads (however, this is limited by the rated output current's rms value).

*6 When the output voltage is 100 V or 200 V and the output frequency is between 40 Hz and 999.9 Hz (reverse current is -180 deg out of phase with the output voltage).

*7 With no load at room temperature

*8 When the output voltage is between 100 V and 212 V (L range) or 200 V and 424 V (H range), the output current is reduced by the output voltage.

*9 Limited by the rated output current's rms value

*10 With respect to changes in the rated range

*11 With respect to 0 % to 100 % changes in the rating
When the output voltage is between 80 V and 150 V (L range) or 160 V and 300 V (H range) and the load power factor is 1. At the output terminal block. When the response mode is set to FAST or MEDIUM.

*12 Between 40 Hz and 999.9 Hz.
When the output voltage is between 80 V and 150 V (L range) or 160 V and 300 V (H range) and the load power factor is 1. This is the output line regulation with 200 Hz as the reference.

*13 With respect to changes in the rated range
When the output voltage range is 100 V or 200 V and the output current is 0 A.

*14 With respect to changes in all rated ranges

*15 When the output voltage is between 80 V and 150 V (L range) or 160 V and 300 V (H range) and the load power factor is 1.

*16 When the output voltage is 100 V or 200 V, the load power factor is 1, and the output current changes from 0 A to the rated value and from the rated value to 0 A.

*17 When the input voltage is 100 V or 200 V, the output voltage is 100 V or 200 V, the output current is the rated value, the load power factor is 1, and the output frequency is between 40 Hz and 999.9 Hz.

*18 With the true rms display, a waveform with a crest factor of 3 or less, DC, output frequency between 40 Hz and 999.9 Hz, RMS, and AVE.

*19 When the output frequency is between 45 Hz and 65 Hz.

*20 Although signals are insulated with output terminals, each signal is common. Logic setting is also possible.

PCR-LE Series Specifications

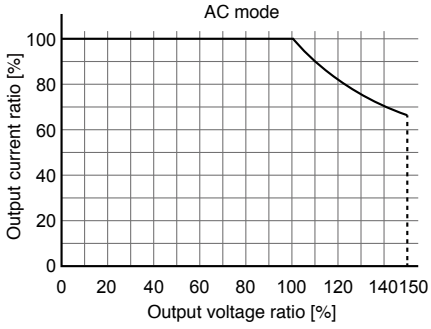
Item/Model		PCR500LE	PCR1000LE	PCR2000LE	PCR3000LE	PCR4000LE	PCR6000LE	PCR9000LE
General								
Insulation resistance	Between input and chassis, output and chassis, and input and output	500 Vdc, 30 MΩ or more			500 Vdc, 10 MΩ or more			
Withstand voltage	Between input and chassis, output and chassis, and input and output	1.5 kVAC for 1 minute						
Circuit method		Linear amplifier system						
Environmental conditions	Operating environment	Indoor use, overvoltage category II						
	Operating temperature range	0 °C to +50 °C (32 °F to +122 °F)						
	Storage temperature range	-10 °C to +60 °C (14 °F to 140 °F)						
	Operating humidity range	20 % rh to 80 % rh (no condensation)						
	Storage humidity range	90 % rh or less (no condensation)						
	Altitude	Up to 2000 m						
Weight		Approx.17 kg (37.48 lb)	Approx. 35 kg (77.16 lb)	Approx. 55 kg (121.25 lb)	Approx. 82 kg (180.78 lb)	Approx. 96 kg (211.64 lb)	Approx. 140 kg (308.64 lb)	Approx. 190 kg (418.88 lb)
Input terminal		Inlet	M4	M5	M8	M8	M8	M5
Output terminal		M4	M4	M4	M5	M5	M8	M8
Accessories	Power cord	1 pc. With plug Length: 3 m	–					
	User's manual	1 copy						
	Safety information	1 copy						
	CD-ROM	1 disc						
Electromagnetic compatibility (EMC) *1, 2		Complies with the requirements of the following directive and standards. EMC Directive 2004/108/EC EN 61326-1 (Class A *3), EN 55011 (Class A *3, Group 1 *4), EN 61000-3-2 *5, EN61000-3-3 *5 The maximum length of all cables and wires connected to the PCR-LE Series must be less than 3 m.						
Safety		*Complies with the requirements of the following directive and standard. Low Voltage Directive 2006/95/EC *2 EN 61010-1 Class I *6, Pollution Degree 2						

*1 Does not apply to specially ordered or modified PCR-LEs. *2 Only on models that have the CE marking on the panel.
*3 This is a Class A equipment. This product is intended for use in an industrial environment. This product may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.
*4 This is a Group 1 equipment. This product does not generate and/or use intentionally radio-frequency energy, in the form of electromagnetic radiation, inductive and/or capacitive coupling, for the treatment of material or inspection/analysis purpose.
*5 Excluding PCR3000LE, PCR4000LE, PCR6000LE and PCR9000LE.
*6 This is a Class I equipment. Be sure to ground this product's protective conductor terminal. The safety of this product is only guaranteed when the product is properly grounded.

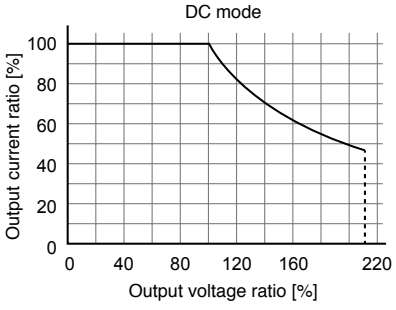
■ Output voltage ratio versus rated output current characteristics

The output voltage ratio is a percentage where 100 % represents an output voltage of 100 V (output L range) or 200 V (output H range) in AC mode or DC mode.
The output current ratio is a percentage where 100 % represents the maximum rated output current in AC mode or DC mode.

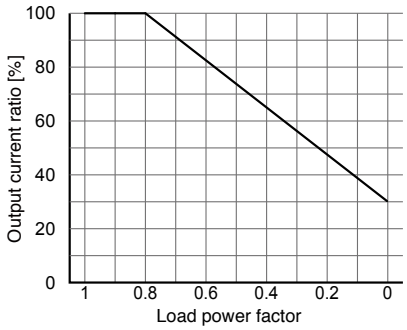
■ Output voltage ratio versus rated output current characteristics (AC mode)



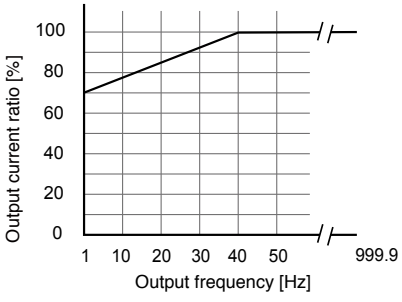
■ Output voltage ratio versus rated output current characteristics (DC mode)



■ Load power factor versus rated output current characteristics



■ Output frequency versus rated output current characteristics



For the "Output voltage ratio versus rated output current characteristics (AC mode)" and "Load power factor versus rated output current characteristics" graphs, the rated output current is the product of the output current ratios shown in both graphs. The output current ratio shown in the "Output frequency versus rated output current characteristics" graph is given priority if it is less than the product of the output current ratios described above. (This only applies to AC mode.)

Compact AC Power Supply (CV/CF)

PCR-M Series

GPIB OPTION | RS-232C | USB OPTION | DRIVERS | CE

Dimensions / Weight

PCR500M :214(8.43″)W × 124(4.88″)H × 350(13.78″)Dmm / 6kg(13.23 lbs)
PCR1000M:429(16.89″)W × 128(5.04″)H × 350(13.78″)Dmm / 11kg(24.25 lbs)
PCR2000M:429(16.89″)W × 128(5.04″)H × 450(17.72″)Dmm / 15kg(33.07 lbs)

Accessories

Operation Manual, Input power cord, CD-ROM*

* Contains the Communication Interface Manual, application software, instrument driver, and VISA library (KI-VISA).

Compact AC power supply using the PWM inverter method

The PCR-M Series is a small-size AC power supply with the ease of a variable auto transformer or an automatic voltage regulator (AVR) and the usefulness of a multifunctional AC power supply. As the PWM inverter method is employed for the power unit, the PCR-M Series is much smaller and lighter than the predecessors while enabling high-quality and highly-efficient (about 70 %) operation. This power supply comes with measurement features, memory feature, protection features and various communication interface options, and it is even possible to provide DC power. When you incorporate an optional analog interface board (EX04-PCR-M), the PCR-M Series can also be used as a booster for arbitrary signal generator. This small and versatile unit can provide you with more work styles than you can imagine. You can't do without it once you use it!

Small and light. Only 6 kg (PCR500M)

Easy to carry with only one hand

Options

■ Interface Board

IB21 (GPIB interface)
US21 (USB interface)
EX04-PCR-M (Analog interface)

Note: Only one interface board can be installed.

■ Sequence Creation Software
Wavy for PCR-M

Features

■ Compact design (PCR500M)

Small enough to fit on your work desk!
Only 214W × 124H × 350D mm!
Weighs only 6 kg and easy to carry!

■ Versatile output modes

Three modes (AC, DC, AC+DC) are available.*1
The frequency range is up to 500 Hz (Resolving power: 0.1Hz).

■ High-quality output waveform

The output voltage varies between 1 V and 135 V or 2 V and 270 V (two ranges). The maximum current is 5A (135 V range) or 2.5A (270 V range) and the peak current can triple the maximum rated current for the rectifier load of the capacitor input type. The distortion rate of output waveform is 0.5 % or less.

■ Memory feature

You can store and recall three combinations of settings for voltage and frequency on the main unit. By calling the memory during output, you can test the sudden changes of voltage or frequency.*2

■ Measurement features

You can measure the voltage, current and power of AC and DC output, apparent power, reactive power, power factor, crest facter and current peak hold.*3

■ Analog interface

By incorporating an optional analog interface (EX04-PCR-M), output can be controlled by using external analog signals. Input DC signals can be used to change output AC voltage and boost input waveform.

■ Control using a PC

You can control the PCR-M Series through the standard RS-232C interface, the optional GPIB interface, or the optional USB interface.*4 By using the control software (Easy Controller for PCR-M Series) comes with the PCR-M Series, you can easily set the parameters of the PCR-M Series and log the output measured values.

*1 : You can access AC+DC mode if you have installed an optional interface board of IB21, US21 or EX04-PCR-M. The communications interface is used to set that mode.
*2 : An installed appropriate optional interface board allows up to ten combinations of settings to be stored in the memory. The communications interface is also used to set or call extended memory addresses (4 to 10).
*3 : You can use the communications interface to measure apparent power (VA), reactive power (VAR), power factor (PF), crest factor (CF), and held current peak.
*4 : Instrument drivers for Microsoft Visual Basic, Microsoft Office VBA, Microsoft Visual C++, LabVIEW, or LabWindows/CVI are also included in the disc.

PCR-M Series Specifications

■Specifications of the main unit

Note: "TYP value" indicates a typical value and does not guarantee the performance. "rdng" indicates a reading on the device.

	PCR500M	PCR1000M	PCR2000M
Input voltage	Nominal rated input: 100 to 120 V AC/200 to 240 V AC, 50/60 Hz, single phase		
	Input voltage range: 90 to 132 V AC/180 to 250 V AC (automatically determined when the power is turned on), 47 to 63 Hz, single phase		
Input current	Up to 9 A/4.5 A	Up to 18 A/9 A	Up to 36 A/18 A
Input power factor *1	0.9 (TYP value)		
Efficiency	At least 70 %		
Output voltage	1 to 135 V AC/2 to 270 V AC (135 V/270 V range)		
	1.4 to 190 V DC/2.8 to 380 V DC (135 V/270 V range)		
Setting Resolution	0.1 V		
Output capacity	AC mode: 500 VA at maximum	AC mode: 1000 VA at maximum	AC mode: 2000 VA at maximum
	DC mode: 400 W at maximum	DC mode: 800 W at maximum	DC mode: 1600 W at maximum
Maximum current	AC mode: 5 A/2.5 A *2	AC mode: 10 A/5 A *2	AC mode: 20 A/10 A *2
	DC mode: 4 A/2 A *3	DC mode: 8 A/4 A *3	DC mode: 16 A/8 A *3
Output frequency	Range: 40 to 500 Hz, setting: 0.1 Hz, accuracy: ±0.02 %		
Output waveform distortion ratio	0.5% or less (at 50 V to 135 V/100 V to 270V at load power factor 1)		
Accuracy of voltmeter	±(0.5 % of rdng + 0.3 V/0.6 V) (Output voltage greater than 13.5 V/27 V and output frequency 45 Hz to 65 Hz/DC at 23 ± 5 °C)		
Accuracy of ammeter (RMS)	±(0.5 % of rdng + 0.02 A/0.01 A)	±(0.5 % of rdng + 0.04 A/0.02 A)	±(0.5 % of rdng + 0.08 A/0.04 A)
	(5 % to 100 % of the maximum output current and output frequency 45 Hz to 65 Hz or DC at 23 ± 5 °C)		
Dimensions (maximum)	214W × 124 (150)H × 350 (395)D mm	429 (450)W × 128 (150)H × 350 (400)D mm	429 (450)W × 128 (150)H × 450 (500)D mm
Weight	Approximately 6 kg	Approximately 11 kg	Approximately 15 kg
Operating temperature and humidity range	0 to 40 °C, 20 %rh to 80 %rh (non-condensing)		
Storage temperature and humidity range	-10 °C to 60 °C, 90 %rh or less (non-condensing)		

*1 When the output voltage is 100 V/200 V (in the 135 V/270 V range), the current is maximum, and the load power factor is 1.
*2 When the output voltage is 1 V to 100 V/2 V to 200 V. Depends on the power capacity when the output voltage is 100 V to 135 V/200 V to 270 V.
*3 When the output voltage is 1.4 V to 100 V/2.8 V to 200. Depends on the power capacity when the output voltage is 100 V to 190 V/200 V to 380 V.

■Specifications of the communication interface

RS-232C	Conforms to EIA232D specifications. D-SUB9 pin connector. Baud rate: 1200, 2400, 4800, 9600, 19200 bps Data length: 8 bits, stop bit: 1 bit, no parity bit, X-Flow contorol
GPIB (IB21: optional)	Conforms to IEEE STD.488.1-1978 specifications. SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E1
USB (US21: optional)	Conforms to USB 2.0 specifications. Conforms to USBTMC-USB488 device class specifications. Communication speed: 12 Mbps (full speed)
Common	Software protocol: IEEE 488.2 STD 1992 Command language: SCPI Specification 1999.0

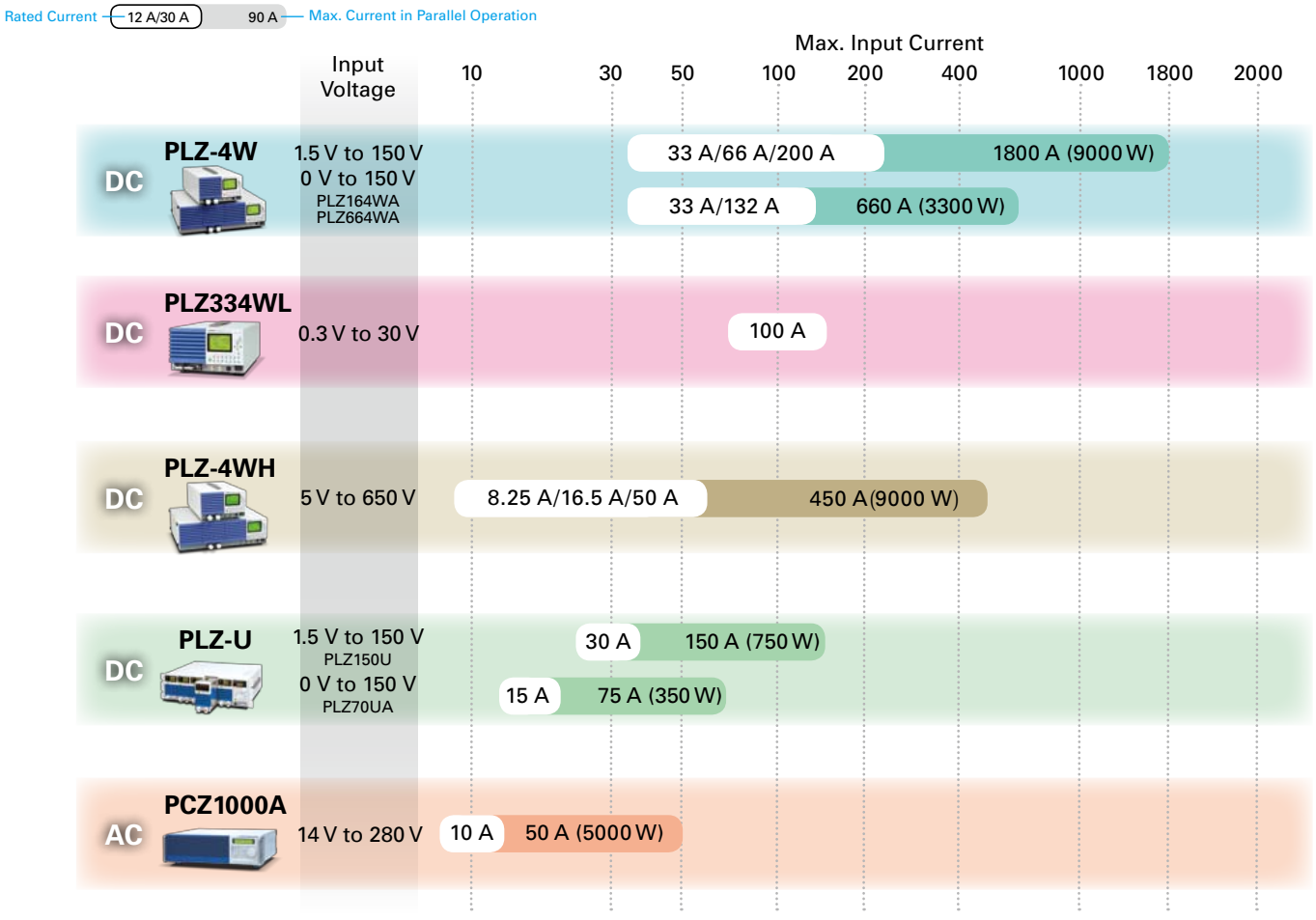
■Analog interface specifications (EX04-PCR-M: optional)

Input terminal	Maximum allowable input voltage		±15 V
	Type		BNC
	Input impedance		10 kΩ ± 5 % (not unbalanced)
	Isolation voltage		±100 Vmax
EXT-AC mode *1	Input voltage range		0 V to ±10 V (DC)
	Voltage amplification rate (135 V/270 V range)		13.5 times or 27 times
	Frequency setting range		40 Hz to 500 Hz
EXT-DC mode	Input voltage range	ATT off	0 V to ±1.90 Vpeak (0 to 1.35 Vrms sine wave)
		ATT on	0 V to ±10 V (DC)
	Input frequency range	ATT off *2	40 Hz to 500 Hz (sine wave)/40 Hz to 100 Hz (square wave)/DC
	Frequency characteristics	ATT off	– 0.3 dB at 500 Hz with respect to 55 Hz (typical value)
	Voltage amplification rate (135 V/270 V range)	ATT off	100 times or 200 times
		ATT on	19 times or 38 times
Output voltage distortion ratio*3			Main unit specifications + 0.5 % or less

*1 ATT is always set to on.
*2 Measurable range for voltage, current and power is DC and from 40 Hz to 500 Hz. The frequency is set based on the input waveform cycle.
*3 In the EXT-AC mode, when direct current is input. In the EXT-DC mode, when a sine wave with 0.1 % or less distortion rate is input.

ELECTRONIC LOAD SELECTION GUIDE

Series		PLZ-4W	PLZ-4WL	PLZ-4WH	PLZ-U	PCZ1000A
Line up		6 models	1 model	4 models	4 models	1 model
Features		Multi Functional	High Speed	High Voltage	Multi Channel	Variable Crest Factor
Input		DC	DC	DC	DC	AC
Mode	CC	✔	✔	✔	✔	✔
	CC+CV	✔	✔	✔	✔	
	CR	✔	✔	✔	✔	✔
	CR+CV	✔	✔	✔	✔	
	CV	✔	✔	✔	✔	
	CP	✔	✔	✔		✔
Input rating (Max.)		165 W/330 W/ 660 W/1000 W	330 W	165 W/330 W/ 1000 W	75 W/150 W	1000 W
		150 V	30 V	650 V	150 V	280 V
		200 A	100 A	50 A	30 A	10 A
Zero Voltage Input		Available	–	–	Available	–
GPIB		Standard	Standard	Standard	Standard	–
RS-232C		Standard	Standard	Standard	Standard	Standard
USB		Standard	Standard	Standard	–	–



Multifunctional Electronic Load (CC/CV/CR/CP)

PLZ-4W Series

GPIB RS-232C USB DRIVERS CE

Suitable design for fuel cell, faster speed and lower voltage testing application of various devices!

The PLZ-4W Series Electronic Load unit is a multifunctional system designed to offer the highest levels of reliability and safety with operation function of constant voltage, constant current, constant power and constant resistance mode. And its control unit comes with GPIB, RS232C and USB as standard equipment, available in 5 models.

A 0 V input operating voltage is available in 2 models (PLZ164WA, PLZ664WA) which are suitable to meet the testing demands for the Fuel Cell, DC/DC converter, SW Power Supply, and any other devices required for the lower operating voltage application. Model PLZ664WA offers the 132A at 0V input as a largest current rating in its class. (33A for model PLZ164WA)

Furthermore, the PLZ-4W features high speed slew rate when switching, it can be used as simulating load for the characteristic, performance, life cycle, aging test in the field of application in Automobile electronics, SW Power Supply manufacturer, Secondary Battery.

To achieve large capacity for testing application at low cost, PLZ1004W can be expanded up to 9 kW by using its 2 kW booster unit (PLZ2004WB).

Dimensions

Type I :214.5(8.44″)W × 124(4.88″)H × 400(15.75″)Dmm
Type II :429.5(16.91″)W × 128(5.04″)H × 400(15.75″)Dmm

Accessories

Setup Guide, Quick Reference(1 each for English and Japanese), CD-R(Contains the User's Manual and the Communication Interface Manual), Input power cable (with a SVT3 18 AWG 3 P plug, 2.4 m), Load input terminal cover, Lock plate (2 pcs.), Load input terminal bolt, nut and spring washer (2 sets)

Features

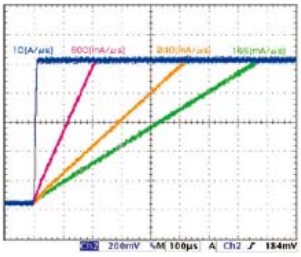
- 6 operation modes (CC, CR, CV, CP, CC+CV, CR + CV)
- 0 V input operating voltage type is available (PLZ164WA, PLZ664WA)
- Equipped with adjustable slew rate for transient switching operations.
- Fast response speed of 10 μs (rise time conversion)
- Soft start function allows you to set the start time
- GPIB/RS232C/USB are standard interface
- Equipped with various protection functions (OVP, OCP, OPP, OHP, UVP, REV)
- Optional Sequence Creation Software (Wavy for PLZ-4W) is available

Functions

■ High-speed response and variable slew-rate

The Electronic Load has been lately required to apply faster response to comply with such latest DC/DC converters with high-speed performance.

With PLZ-4W Series, a faster response of rise/fall time as calculated conversion value with 10 μs is made possible, enabling a transient response test for the direct current and accurate reproduction of a simulation waveform as a dummy load. In addition, instead of the conventional rise/fall time settings, it also can be set with a slew rate (A/μs). As for the setting value, it can be varied continuously, and be possible to optimize transient control for voltage drops due to wiring inductance, constant-voltage power supply, etc., when the load current is switched on.



▲ A current waveform shifting by variable slew-rate

* Adequate slew rate performance is guaranteed as long as the change in the current remains within the 2 %-to-100 % range of the rating. The maximum rise time is limited to 10 μs. If the change in the current is small, the slew rate value may not be stored for the reason stated above.

■ 0 V input

The 164WA and 664WA of PLZ-4W Series permit a load input up to the rated current even when the Input Voltage is set for 0 V. This is an absolute required specification for single cell tests of the fuel cells. Also, because of the low power consumption and scaling down of semi-conductor processes, semi-conductor devices are experiencing further voltage reductions. The Load can meet with these applications of power evaluation test. Higher precision is offered for current settings. Resolutions in micro currents are ensured by 3-range configuration. (Resolving power 10 μA set with L range of PLZ164W and 164WA is possible) Further, each display for the voltmeter, ammeter, and wattmeter now uses a 5-digit display.

■ Sequence function

Sequence patterns set as you requested can be saved in the built-in memory. In the sequence program, 10 normal sequences and 1 first sequence can be saved. 256 steps of normal sequences, and 1024 steps of the first sequence can be saved in each program.

Simple editing is possible using the large liquid crystal display (LCD).

■ Convenient function for discharging test of cells

The PLZ4W can measure the time from load-on to load-off. When combined with under voltage protection (UVP) function, the time from when the battery discharge is started until the battery voltage falls to the cutoff voltage can be measured. Also, you can set the timer so it will load-off automatically after a specified time elapses from load-on mode. Once this timer is set, the input voltage value immediately before load-off is displayed, so it is possible to measure the closed circuit voltage after a specified time elapses from the start of discharging battery.

■ Booster unit PLZ2004WB*

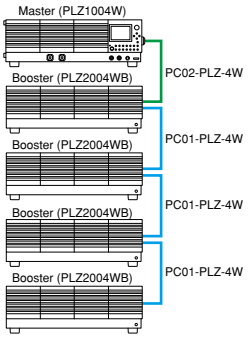
To achieve a large capacity system at low cost, the PLZ1004W has an expandable option PLZ2004WB as a booster unit.

Using 1 PLZ1004W as a master unit, a maximum of 4 booster units can be parallel connected. (Max. 9 kW, 1800 A)

*PLZ2004WB(Booster unit) can be used for the PLZ1004W only. It cannot be connected and used with any other model.

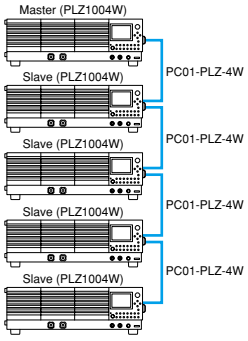
■ Specifications

Operating voltage	1.5 V to 150 V
Current	400 A
Power	2000 W
Input voltage	AC100 V to 240 V (AC90 V to 250 V) single phase, continuous
Power consumption	200 VA(max)
Dimensions	Type II (The depth is 550(600) mm)
Weight	approx.23 kg



■ Parallel operation

Under parallel operation, the same model can be parallel connected to a maximum of 5 units when booster unit is not used. (Max. 5 kW, 1000 A)



PC01-PLZ-4W: The cable for Boosters and Master/Slave units.
PC02-PLZ-4W: The cable for between Master unit and Booster unit.

■ GPIB, RS-232C, USB as standard equipment

The system comes with interfaces GPIB, RS-232C and USB as standard equipment. All the interfaces comply with SCPI (standard commands for programmable instruments) as well as IEEE488.2

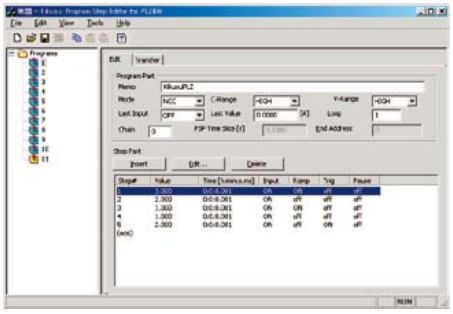
■ Other functions

The PLZ-4W Series has equipped with all the same functions of its former type of the PLZ-3W Series, such as the Soft-start Function, Lock Function, Short Function, ABC Memory Function, Set-up Memory Function, Switching Functions, etc.

■ Sample program

We have prepared sample programs for the PLZ-4W Series at our website. (Free download service). These include the Utility software [MEMcopy] to read, or save the set-up memory content from media such as floppy disc, the Sequence Editing software [StepEdit], and Visual Basic applications such as measured data collection and GUI remote control, and their source code [VB Sample].

Even if you don't have the expensive GPIB card or the programming skills, you can start measuring easily by installing these software and USB drivers in a Windows PC (compatible with Windows 98 or later) with USB mounted, and link the PLZ-4W Series via a USB cable.



▲ Application Software

Options

■ Accessory Kit

OP01-PLZ-4W

(used for the connection of J1 connector on the rear panel when operating by external control)

● Connector, Semi-cover, Pin 20 pcs.

■ Parallel Operation Cable

PC01-PLZ-4W

(for boosters and master/slave units, 300 mm)

PC02-PLZ-4W

(for between master unit and booster unit, 550 mm)

■ Sequence Creation Software Wavy for PLZ-4W

[NOTICE] PLZ-164WA and PLZ664WA

● Operating voltage is secured by the input node of the load device. Please select load wiring that does not make input node voltage of the load device become 0 V or less. In addition, this equipment detects non-input. It detects non-input and stops electric current when the input node voltage of the load device is 0.3 V or less and input current is approximately 1% of the current rating or less.

● PLZ164WA and PLZ664WA are equipped with bias supply inside. In the case of supply for which diode is arranged from minus output to plus output, such as switching supply, an electric current flows from the bias supply to the diode and an alarm for reverse connection occurs when turning off the output of the supply under test while this equipment is loaded on.

● Because a noise filter is used for the primary input for PLZ164WA and PLZ664WA, the leakage breaker, etc. may be activated, depending on the environment of the input power, when using multiple quantities of them at the same time. Therefore, we provide models for customers who are planning to use multiple devices at the same time. If you have any other questions, please contact our sales department for details.

PLZ-4W Series Specifications

Unless specified otherwise, the specifications are for the following settings and conditions.
- The warm-up time is 30 minutes (with current flowing).
- After warm-up is complete, the PLZ-4W must be calibrated correctly according to the procedures given in the operation manual in a 23 °C±5 °C environment.
- ** % of set denotes ** % of the input voltage, input current, or input power setting.
- ** % of f.s denotes ** % of the rated input voltage, rated input current, or rated input power.
- **% of rdg represents denotes ** % of the input voltage, input current, or input power reading.

Model			PLZ164W	PLZ334W	PLZ1004W	PLZ164WA	PLZ664WA
Rating							
Operating voltage (DC)			1.5 V – 150 V *1			0 V – 150 V *2	
Current			33 A	66 A	200 A	33 A	132 A
Power			165 W	330 W	1000 W	165 W	660 W
Minimum start voltage *3			0.3 V or greater				
CC mode							
Operating range	Range	H	0 A – 33 A	0 A – 66 A	0 A – 200 A	0 A – 33 A	0 A – 132 A
		M	0 A – 3.3 A	0 A – 6.6 A	0 A – 20 A	0 A – 3.3 A	0 A – 13.2 A
		L	0 A – 330 mA	0 A – 660 mA	0 A – 2 A	0 A – 330 mA	0 A – 1.32 A
Setting range	Range	H	0 A – 34.65 A	0 A – 69.3 A	0 A – 210 A	0 A – 34.65 A	0 A – 138.6 A
		M	0 A – 3.465 A	0 A – 6.93 A	0 A – 21 A	0 A – 3.465 A	0 A – 13.86 A
		L	0 A – 346.5 mA	0 A – 693 mA	0 A – 2.1 A	0 A – 346.5 mA	0 A – 1.386 A
Resolution	Range	H	1 mA	2 mA	10 mA	1 mA	10 mA
		M	0.1 mA	0.2 mA	1 mA	0.1 mA	1 mA
		L	0.01 mA	0.02 mA	0.1 mA	0.01 mA	0.1 mA
Accuracy of setting	Range	H, M	±(0.2 % of set + 0.1 % of f.s *1) + Vin *2/500 kΩ				
		L	±(0.2 % of set + 0.1 % of f.s)				
Input voltage variation*3	Range	H	2 mA	4 mA	10 mA	2 mA	8 mA
		M	2 mA	4 mA	10 mA	2 mA	8 mA
		L	0.1 mA	0.2 mA	0.6 mA	0.1 mA	0.4 mA
Ripple		rms *4	3 mA	5 mA	20 mA *6	7.5 mA	30 mA*6
		p-p *5	30 mA	50 mA	100 mA*6	50 mA	200 mA*6
CR mode							
Operating range *1	Range	H	22 S – 400 µS (45.455 mΩ – 2.5 kΩ)	44 S – 800 µS (22.727 mΩ – 1.25 kΩ)	133.332 S – 2.4 mS (7.5 mΩ – 416.666 Ω)	22 S – 400 µS (45.455 mΩ – 2.5 kΩ)	88 S – 1.6 mS (11.363 mΩ – 625 Ω)
		M	2.2 S – 40 µS (454.55 mΩ – 25 kΩ)	4.4 S – 80 µS (227.27 mΩ – 12.5 kΩ)	13.3332 S – 2420 µS (75 mΩ – 4.1666 kΩ)	2.2 S – 40 µS (454.55 mΩ – 25 kΩ)	8.8 S – 160 µS (113.63 mΩ – 6.25 kΩ)
		L	0.22 S – 4 µS (4.545 5 Ω – 250 kΩ)	0.44 S – 8 µS (2.272 7 Ω – 125 kΩ)	1.33332 S – 24 µS (750 mΩ – 41.666 kΩ)	0.22 S – 4 µS (4.545 5 Ω – 250 kΩ)	0.88 S – 16 µS (1.136 3 mΩ – 62.5 kΩ)
Setting range	Range	H	23.1 S – 0 S (43.290 mΩ – OPEN)	46.1 S – 0 S (21.692 mΩ – OPEN)	139.9968 S – 0 S (7.1430 mΩ – OPEN)	23.1 S – 0 S (43.290 mΩ – OPEN)	92.4 S – 0 S (10.822 mΩ – OPEN)
		M	2.31 S – 0 S (432.9 mΩ – OPEN)	4.61 S – 0 S (216.92 mΩ – OPEN)	13.99968 S – 0 S (71.430 mΩ – OPEN)	2.31 S – 0 S (432.9 mΩ – OPEN)	9.24 S – 0 S (108.22 mΩ – OPEN)
		L	0.231 S – 0 S (4.329 Ω – OPEN)	0.461 S – 0 S (2.1692 Ω – OPEN)	1.399968 S – 0 S (714.30 mΩ – OPEN)	0.231 S – 0 S (4.329 Ω – OPEN)	0.924 S – 0 S (1.0822 Ω – OPEN)
Resolution	Range	H	400 µS	800 µS	2.424 mS	400 µS	1.6 mS
		M	40 µS	80 µS	242.4 µS	40 µS	160 µS
		L	4 µS	8 µS	24.24 µS	4 µS	16 µS
Accuracy of setting *2	Range	H, M	±(0.5 % of set *3 + 0.5 % of f.s *4) + Vin/500 kΩ				
		L	±(0.5 % of set *3 + 0.5 % of f.s)				
CV mode							
Operating range	Range	H	1.5 V – 150 V			0 V – 150 V	
		L	1.5 V – 15 V			0 V – 15 V	
Setting range	Range	H	0 V – 157.5 V				
		L	0 V – 15.75 V				
Resolution	Range	H	10 mV				
		L	1 mV				
Accuracy of setting	Range	H, L	±(0.1 % of set + 0.1 % of f.s)				
Input current variation*1			12 mV				
CP mode							
Operating range	Range	H	16.5 W – 165 W	33 W – 330 W	100 W – 1000 W	16.5 W – 165 W	66 W – 660 W
		M	1.65 W – 16.5 W	3.3 W – 33 W	10 W – 100 W	1.65 W – 16.5 W	6.6 W – 66 W
		L	0.165 W – 1.65 W	0.33 W – 3.3 W	1 W – 10 W	0.165 W – 1.65 W	0.66 W – 6.6 W
Setting range	Range	H	0 W – 173.25 W	0 W – 346.5 W	0 W – 1050 W	0 W – 173.25 W	0 W – 693 W
		M	0 W – 17.325 W	0 W – 34.65 W	0 W – 105 W	0 W – 17.325 W	0 W – 69.3 W
		L	0 W – 1.7325 W	0 W – 3.465 W	0 W – 10.5 W	0 W – 1.732 5 W	0 W – 6.93 W
Resolution	Range	H	10 mW	10 mW	100 mW	10 mW	20 mW
		M	1 mW	1 mW	10 mW	1 mW	2 mW
		L	0.1 mW	0.1 mW	1 mW	0.1 mW	0.2 mW
Accuracy of setting	Range	H, M	±(0.6 % of set + 1.4 % of f.s*1)				
		L	±(0.6 % of set + 1.4 % of f.s)				

[rating]
*1 The minimum operating voltage (including the voltage drop due to the wire inductance component) in switching mode increases by 0.15 V per 1 A/µs at slew rate settings greater than 5 A/µs.
*2 The minimum operating voltage (including the voltage drop due to the wire inductance component) in switching mode increases by 0.3 V per 1 A/µs at slew rate settings greater than 5 A/µs.
*3 Minimum voltage at which the current starts flowing to the PLZ-4W. (The PLZ-4W detects no signal at an input voltage less than or equal to approximately 0.3 V and an input current less than or equal to approximately 1 % of the range rating. Therefore, if the input voltage is gradually increased from 0 V, no current will flow until 0.3 V is exceeded. Once a current greater than or equal to 1 % of the range rating starts flowing, the current can flow at voltages less than equal to 0.3 V.)

[CC mode]
*1 Full scale of H range
*2 Vin: Input terminal voltage of Electronic Load
*3 When the input voltage is varied from 1.5 V to 150 V at a current of rated power/150 V.
*4 Measurement frequency bandwidth: 10 Hz to 1 MHz
*5 Measurement frequency bandwidth: 10 Hz to 20 MHz
*6 At measurement current of 100 A

[CR mode]
*1 Conductance [S] = Input current [A] / input voltage [V] = 1/resistance [Ω]
*2 Converted value at the input current. At the sensing point.
*3 set = Vin/Rset
*4 Full scale of H range

[CV mode]
*1 With respect to a change in the current of 10 % to 100 % of the rating at an input voltage of 1.5 V (during remote sensing).

[CP mode]
*1 Full scale of H range

PLZ-4W Series Specifications

Model			PLZ164W	PLZ334W	PLZ1004W	PLZ164WA	PLZ664WA
Meters							
Voltmeter	Range	H, M	0.00 V – 150.00 V				
		L	0.000 V – 15.000 V				
	Accuracy		±(0.1 % of rdg + 0.1 % of f.s)				
Ammeter	Range	H, M	0.000 A – 33.000 A	0.000 A – 66.000 A	0.00 A – 200.00 A	0.000 A – 33.000 A	0.00 A – 132.00 A
		L	0.00 A – 330.00 mA	0.00 A – 660.00 mA	0.0000 A – 2.0000 A	0.00 A – 330.00 mA	0.000 A – 1.3200 A
	Accuracy		±(0.2 % of rdg + 0.3 % of f.s)				
Wattmeter*1	Range	H, M	0.00 W – 165.00 W	0.00 W – 330.00 W	0.0 W – 1000.0 W	0.00 W – 165.00 W	0.00 W – 660.00 W
		L*2	0.000 W – 49.500 W	0.000 W – 99.000 W	0.00 W – 300.00 W	0.000 W – 49.500 W	0.000 W – 198.00 W
		L*3	0.0000 W – 1.6500 W	0.0000 W – 3.3000 W	0.000 W – 10.000 W	0.0000 W – 1.6500 W	0.0000 W – 6.6000 W
Switching mode							
Operation mode			CC and CR				
Duty cycle setting			5 % – 95 %*1, 0.1 % step				
Selectable frequency range			1 Hz – 20 kHz				
Frequency resolution	1 Hz – 10 Hz		0.1 Hz				
	10 Hz – 100 Hz		1 Hz				
	100 Hz – 1 kHz		10 Hz				
	1 kHz – 20 kHz		100 Hz				
Frequency accuracy of setting			±(0.5 % of set)				
Slew rate							
Setting range *1	Range	H	2.5 mA/µs – 2.5 A/µs	5 mA/µs – 5 A/µs	16 mA/µs – 16 A/µs	2.5 mA/µs – 2.5 A/µs	10 mA/µs – 10 A/µs
		M	250 µA/µs – 250 mA/µs	500 µA/µs – 500 mA/µs	1.6 mA/µs – 1.6 A/µs	250 µA/µs – 250 mA/µs	1 mA/µs – 1 A/µs
		L	25 µA/µs – 25 mA/µs	50 µA/µs – 50 mA/µs	160 µA/µs – 160 mA/µs	25 µA/µs – 25 mA/µs	100 µA/µs – 100 mA/µs
Resolution			See below.				
Accuracy of setting*2			±(10 % of set + 5 µs)				
Slew rate resolution							
PLZ164W PLZ164WA	Setting		25 µA/µs – 250 µA/µs	250 µA/µs – 2.5 mA/µs	2.5 mA/µs – 25 mA/µs	25 mA/µs – 250 mA/µs	250 mA/µs – 2.5 A/µs
	Resolution		100 nA	1 µA	10 µA	100 µA	1 mA
PLZ334W	Setting		50 µA/µs – 500 µA/µs	500 µA/µs – 5 mA/µs	5 mA/µs – 50 mA/µs	50 mA/µs – 500 mA/µs	500 mA/µs – 5 A/µs
	Resolution		200 nA	2 µA	20 µA	200 µA	2 mA
PLZ664WA	Setting		100 µA/µs – 1 mA/µs	1 mA/µs – 10 mA/µs	10 mA/µs – 100 mA/µs	100 mA/µs – 1 A/µs	1 A/µs – 10 A/µs
	Resolution		400 nA	4 µA	40 µA	400 µA	4 mA
PLZ1004W	Setting		160 µA/µs – 1.6 mA/µs	1.6 mA/µs – 16 mA/µs	16 mA/µs – 160 mA/µs	160 mA/µs – 1.6 A/µs	1.6 A/µs – 16 A/µs
	Resolution		600 nA	6 µA	60 µA	600 µA	6 mA
Soft start							
Operation mode			CC and CR				
Selectable time range			1, 2, 5, 10, 20, 50, 100, or 200 ms				
Time accuracy			±(30 % of set +100 µs)				
Remote sensing							
Voltage that can be compensated			2 V for a single line				
Protection function							
Overvoltage protection (OVP)			Turns off the load at 110 % of the rated voltage				
Overcurrent protection (OCP)			0.03 A – 36.3 A	0.06 A – 72.6 A	0.2 A – 220 A	0.03 A – 36.3 A	0.13 A – 145.2 A
			Or 110 % of the maximum current of each range				
Overpower protection (OPP)			0.1 W – 181.5 W	0.3 W – 363 W	1 W – 1 100 W	0.1 W – 181.5 W	0.6 W – 726 W
			Or 110 % of the maximum power of each range Load off or limit selectable				
Overheat protection (OHP)			Turns off the load when the heat sink temperature reaches 95 °C				
Undervoltage protection (UVP)			Turns off the load when detected.				
			Can be set in the range of 0 V to 150 V or Off.				
Reverse connection protection (REV)			By diode and fuse. Turns off the load when an alarm occurs.				

[Meters]

*1 Displays the product of the voltmeter reading and ammeter reading.

*2 In a mode other the CP mode

*3 In CP mode

[Switching mode]

*1 The minimum time width is 10 µs. Between 5 kHz and 20 kHz, the maximum duty cycle is limited by the mini-mum time width.

[Slew rate]

*1 In CC mode. The maximum slew rate of each range is 1/10th the value in CR mode.

*2 Time to reach from 10 % to 90 % when the current is varied from 2 % to 100 % of the rated current.

PLZ-4W Series Specifications

Model		PLZ164W	PLZ334W	PLZ1004W	PLZ164WA	PLZ664WA
Sequence function						
Normal sequence	Operation mode	CC, CR, CV, or CP				
	Maximum number of steps	256				
	Step execution time	1 ms – 999 h 59 min				
	Time resolution	1 ms (1 ms – 1 min)/100 ms (1 min – 1 h)/1 s (1 h – 10 h)/ 10 s (10 h – 100 h)/1 min (100 h – 999 h 59 min)				
Fast sequence	Operation mode	CC or CR				
	Maximum number of steps	1024				
	Step execution time	25 µs – 100 ms				
	Time resolution	25 µs (25 µs – 100 µs)/100 µs (100 µs – 100 ms)				
Others, Common specifications						
Elapsed time display		Measures the time from load on to load off. On/Off selectable.				
		Measures from 1 s up to 999 h 59 min 59 s				
Auto load off timer		Automatically turns off the load after a specified time elapses.				
		Can be set in the range of 1 s to 999 h 59 min 59 s or off				
Front panel BNC connector	TRIG OUT	Trigger output: Approx. 4.5 V, pulse width: Approx. 2 µs, output impedance: Approx. 500 Ω				
		Outputs a pulse during sequence operation and switching operation.				
	I MON OUT	Current monitor output				
		1 V f.s (H or L range) and 0.1 V f.s (M range)				
Communication function	GPIB	IEEE std. 488.1-1978				
		SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E1				
		Supports the SCPI and IEEE std. 488.2-1992 command set				
		Sets panel functions except the power switch and reads measured values				
	RS-232C	D-SUB 9-pin connector (conforms to EIA-232-D)				
		Sets panel functions except the power switch and reads measured values				
		Supports the SCPI and IEEE std. 488.2-1992 command set				
		Baud rate: 2400, 4800, 9600, 19200 bps				
		Data length: 8-bit, Stop bit: 1, 2-bit, Parity bit: None, Flow control: Xon/Xoff				
	USB	Conforms to USB 2.0 Specifications and USBTMC-USB488 Device Class Specifications				
		Sets panel functions except the power switch and reads measured values				
		Communication speed 12 Mbps (Full speed)				
General Specifications						
Input voltage range		100 VAC – 240 VAC (90 VAC – 250 VAC) Single phase, continuous			100 VAC – 120 VAC/200 VAC – 240 VAC (90 VAC – 132 VAC/180 VAC – 250 VAC) Single phase	
Input frequency range		47 Hz – 63 Hz				
Power consumption		80 VAmax	90 VAmax	160 VAmax	450 VAmax	1500 VAmax
Inrush current		45 A			80 A	
Operating temperature range		0 °C – 40 °C				
Operating humidity range		20 % – 85 % RH (without condensation)				
Storage temperature range		–25 °C – 70 °C				
Storage humidity range		90 % RH or less (without condensation)				
Isolation voltage		±500 V				
Insulation resistance	Primary - input terminal	500 VDC, 30 M Ω or more (ambient humidity of 70 % RH or less)				
	Primary - chassis	500 VDC, 30 M Ω or more (ambient humidity of 70 % RH or less)				
Withstand voltage	Primary - input terminal	No abnormalities at 1500 VAC for 1 minute.				
	Primary - chassis	No abnormalities at 1500 VAC for 1 minute.				
Dimensions (mm)		See outline drawing				
Weight		Approx. 7 kg	Approx. 8 kg	Approx. 15 kg	Approx. 7.5 kg	Approx. 16 kg
Battery backup		Backs up setup information				
Accessories		Power cord × 1 pc. (with SVT3, 18AWG, 3-pin plug, cable length of 2.4 m), Load input terminal cover × 1 piece (2 lock plates provided), Set of screws for the load input terminal × 2 sets (bolts, nuts, and spring washers), Operation manual × 1 copy, Setup Guide, Quick Reference(1 each for English and Japanese), CD-R(Contains the User's Manual and the Communication Interface Manual)				
Electromagnetic compatibility (EMC) *1		Conforms to the requirements of the following directive and standard. EMC Directive 89/336/EEC EN61326:1997/A2:2001 Emissions: Class A Immunity: Minimum immunity test requirements EN61000-3-2:2000 EN61000-3-3:1995/A1:2001				
Safety *1 *2		Conforms to the requirements of the following directive and standard. Low Voltage Directive 73/23/EEC EN61010-1:2001 Class I Pollution degree 2				

[General Specifications]

*1 Only on models that have CE marking on the panel.
Not applicable to custom order models.

*2 This instrument is a Class I equipment. Be sure to ground the protective conductor terminal of the instrument.
The safety of the instrument is not guaranteed unless the instrument is grounded properly.

Multifunctional Electronic Load (CC/CV/CR/CP)

PLZ334WL

GPIB RS-232C USB DRIVERS CE

NEW

Large Current DC Electronic Load with Fast Slew Rate(50 A/μs)

While the PLZ334WL succeeds to the superior operability of our conventional model of the PLZ-4W series, the PLZ-4WL series realizes the fast rise and fall time (slew rate of 50 A/μs.) in the range of low voltage with large current. The PLZ-4WL offers six operation modes, and equips with various features such as sequence operation, switching operation, soft-start function, and time and voltage measurement. The PLZ-4WL applies not only for the conventional load test of the CPU power supply, but also it can be applied to even faster current response test. In addition, the PLZ-4WL is a space-saving design (about 50 % less volume of the conventional model) that can save the facility space of the testing site, and it can be applied for the single cell testing of the large scale rechargeable battery.

Dimensions

214.5(8.45")W×124(4.88")H×400(15.75")Dmm

Accessories

Setup Guide, Quick Reference (1 each for English and Japanese), CD-R (Contains the User's Manual and the Communication Interface Manual), Power cord, Set of screws for the load input terminal (2 sets.), Load input terminal cover, Screws for the Input terminal cover (2 pcs.), Protection dummy plug for J1 terminal, Connecting cable to the chassis

Options

■ Low inductance cable

TL01-PLZ (50 cm) TL02-PLZ (1 m) TL03-PLZ (2 m)

■ Sequence Creation Software
Wavy for PLZ-4W

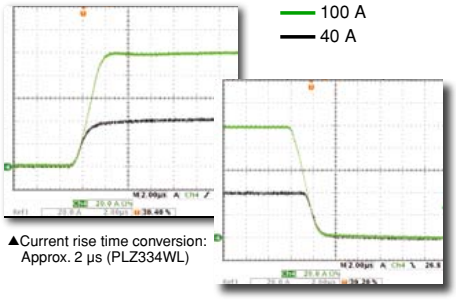
Features

- ■ Full-Load Current of 100 A at 0.3 V!
  Possible to operate as low as 50 mV of the input voltage
- ■ Realize the fast slew rate of 50 A/μs at 2.3 V of the load input terminal voltage. (Rise/Fall time conversion: Approx. 2 μs)
- ■ Current setting resolution: 50 μA (L range)
- ■ 6 operation modes (CC, CR, CV, CP, CC+CV, CR + CV)
- ■ Equipped with Sequence function and Switching function
- ■ Elapsed Time Display function and Auto Load-Off Timer function are convenient for the discharge tests of batteries.
- ■ GPIB/RS232C/USB are standard interface
- ■ Available for input voltage range AC100 V to 120 V/200 V to 240 V
- ■ Equipped with various protection functions (OVP, OCP, OPP, OHP, UVP, REV)
- ■ Optional Low Inductance cables are available exclusively for PLZ-4WL series.
- ■ Optional Sequence Creation Software (Wavy for PLZ-4W) is available

Functions

■ Fast Slew rate

Realize the slew rate of 50 A/μs at 2.3 V of the load input terminal voltage.

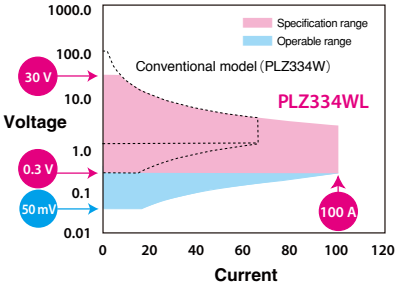


▲Current rise time conversion: Approx. 2 μs (PLZ334WL)

▲Current fall time conversion: Approx. 2 μs(PLZ334WL)

■ Realizing the low voltage operation

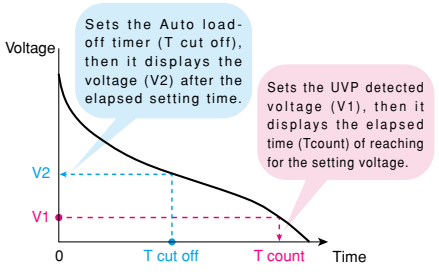
Possible to operate as low as 50 mV by the input voltage. Even below the input voltage of 0.3 V, this product can be used by reducing the current.



▲Conceptual drawingof the operating range

■ Convenient feature for the discharge testing

The Auto load-off timer and the Cut-off features can be applied to the discharge capacity measurement of the rechargeable battery



PLZ334WL Specifications

model			PLZ334WL
Rating	Operating voltage (DC)		0.3 V to 30 V
			Minimum operating voltage for the Switching mode(includes the value of voltage drop generated by the inductance component of wirings) increases approximately 40 mV per 1 A/µs of the slew rate setting.
	Current		100 A
	Power		330 W
	Minimum start voltage *1		50 mV(typ)
Constant Current (CC) mode	Operating range	H	0 A to 100 A
		M	0 A to 10 A
		L	0 A to 1 A
	Setting range	H	0 A to 105 A
		M	0 A to 10.5 A
		L	0 A to 1.05 A
	Resolution	H	5 mA
		M	0.5 mA
		L	0.05 mA
	Accuracy of setting	H, M, L	±(0.2 % of set + 0.1 % of f.s.*2) + Vin/150 k*3
	Input voltage variation *4	H, M, L	±(0.1 % of set + 0.02 % of f.s.*2)
	Ripple	rms *5	8 mA
		p-p *6	80 mA
Constant Resistance (CR) mode	Operating range	H	330 S to 6 mS
			(3.03 mΩ to 166.7 Ω)
		M	33.3 S to 600 µS
			(30.3 mΩ to 1.667 kΩ)
		L	3.3 S to 60 µS
			(303 mΩ to 16.67 kΩ)
	Setting range	H	346.5 S to 0 S
			(2.886 mΩ to OPEN)
		M	34.65 S to 0 S
			(28.86 mΩ to OPEN)
		L	3.465 S to 0 S
			(288.6 mΩ to OPEN)
	Resolution	H	6 mS
		M	600 µS
		L	60 µS
	Accuracy of setting *7	H, M, L	±(0.5 % of set *8 + 0.5 % of f.s.*2) + Vin/150 k
Constant Voltage (CV) mode	Operating range	H	0.3 V to 30 V
		L	0.3 V to 4 V
	Setting range	H	0 V to 31.5 V
		L	0 V to 4.2 V
	Resolution	H	2 mV
		L	200 µV
	Accuracy of setting		±(0.1 % of set + 0.1 % of f.s.)
	Input current variation *9		12 mV
Constant Power (CP) mode	Operating range	H	33 W to 330 W
		M	3.3 W to 33 W
		L	0.33 W to 3.3 W
	Setting range	H	0 W to 346.5 W
		M	0 W to 34.65 W
		L	0 W to 3.465 W
	Resolution	H	20 mW
		M	2 mW
		L	0.2 mW
	Accuracy of setting	H, M, L	±(2.5 % of f.s. *2)
Voltmeter	Display	H	0.000 V to 30.000 V
		L	0.0000 V to 4.0000 V
	Accuracy		± (0.1 % of rdg + 0.1 % of f.s.)
Ammeter	Display	H, M	0.00 A to 100.00 A
		L	0.0000 A to 1.0000 A
	Accuracy		± (0.2 % of rdg + 0.3 % of f.s.)
Wattmeter	Display	H, M	0.00 W to 330.00 W
		L*15	0.000 W to 30.000 W
		L*16	0.0000 W to 3.3000 W
Switching mode	Operation mode		CC/CR mode
	Selectable frequency range		1 Hz to 50 kHz
	Duty cycle setting		5 % to 95 % 1 % step *10
	Accuracy of frequency setting		±(0.5 % of set)
Slew rate	Selectable range (CC)	H	5 mA/µs to 50 A/µs
		M	500 µA/µs to 5 A/µs
		L	50 µA/µs to 500 mA/µs
	Accuracy of setting *11		±(10 % of set + 0.8 µs)
Soft start	Operation mode		CC mode
	Selectable time range *12		Off, 100 µs, 200 µs, 500 µs, 1000 µs, 2 ms, 5 ms,10 ms,20 ms
	Accuracy of setting		±(30 % of set + 10 µs)
Response	Response speed		NORMAL, FAST
Remote sensing	Sensing voltage that can be compensated		3 V for a single line
Protection function	Overvoltage protection (OVP)		Turns off the load at 115 % of the rated voltage
	Overcurrent protection (OCP)		Setting range 10 % to 110 % of the rated current Load off or limit selectable
	Overpower protection (OPP)		Setting range 10 % to 110 % of the rated power Load off or limit selectable
	Overheat protection (OHP)		Turns off the load when the heat sink temperature reaches 90 °C
	Undervoltage protection (UVP)		Turns off the load when detected. Can be set in the range of 0.3 V to 30 V
	Reverse connection protection (REV)		By diode and fuse. Turns off the load when an alarm occurs.

model				PLZ334WL
Sequence function	Normal sequence			
	Operation mode			CC, CR, CV, CP
	Maximum number of steps			256
	Step execution time			1 ms to 999 h 59 min
	Resolution			1 ms, 100 ms, 1 s, 10 s, 1 min
	Fast sequence			
	Operation mode			CC, CR
	Maximum number of steps			1024
	Step execution time			25 µs to 100 ms
	Resolution			25 µs (25 µs to 100 µs)
				100 µs(100 µs to 100 ms)
Other functions	Elapsed time display			Measures the time from load on to load off. On/Off selectable. Measures from 1 s up to 999 h 59 min 59 s.
	Auto load off timer			Measures the time from load on to load off. Can be set in the range of 1 s to 999 h 59 min 59 s or off.
Input / Output signal	J1 connector			26-pin MIL connector
			EXT cont MODE	CC/CR/CP External Voltage Control, 0 to 100 % of the rating of Range by 0 to 10V
			EXT cont ADD	CC mode External Voltage Control, 0 to 100 % of the Local setting value of the rating Range by 0 to ±10 V, Adding up the value to the setting value of ExtCont.
			EXT cont CV	CV mode External Voltage Control, 0 to 100 % of the rating of Range by 0 to 10V
			IMON	Current monitor output, 10 Vf.s. (H/L range), 1 Vf.s. (M range)
			LOAD CONT INPUT	CMOS signal L level (or H level) Load On, Switchable to the logic level
			RANGE CONT	External range switch input, 2 bit
			ALARM INPUT	The alarm activates when the L level of CMOS signal is applied for more than 10 µs. The internal circuit pulls up to 5 V by 10 kΩ
			TRIG INPUT	When it is in the pause condition, the pause can be cancelled when the L level of CMOS signal is applied for more than 10 µs. The internal circuit pulls up to 5 V by 10 kΩ
			ALARM CLEAR INPUT	The alarm can be cleared when the L level of CMOS signal is applied for more than 100 ms. The internal circuit pulls up to 5 V by 10 kΩ
			LOAD ON STATUS	On when the load is on. Open collector by the photo coupler
			RANGE STATUS	Range status output. 2 bit
			ALARM STATUS	On when the alarm is on(OVP、OCP、OPP、OHP、REV、UVP) or Turns on when the external alarm is applied
			SHORT SIGNAL OUT	Relay contact output (DC30 V/1 A)
	Front panel BNC connector			
			TRIG OUT	Outputs a pulse during sequence operation and switching operation.
			IMON OUT	1 V f.s(H/L range), 0.1 V f.s(M range)Isolated to the internal common(connected to the chassis potential)
Communication function	GPIB, RS-232C, and USB interfaces are equipped as standard.			
General Specifications	Input voltage range			100 V AC to 240 V AC (90 V AC to 250 V AC), Single phase
	Input frequency range			47 Hz to 63 Hz
	Power consumption			95 VAmax
	Inrush current *13			65 Amax
	Operating temperature range			0 °C to 40 °C
	Operating humidity range			20 % to 85 % RH (without condensation)
	Storage temperature range			-20 °C to 70 °C
	Storage humidity range			90 % RH or less (without condensation)
	Isolation voltage			±500 V
	Insulation resistance	Primary - input terminal		500 VDC, 30 M or more (ambient humidity of 70 % RH or less)
		Primary - chassis		500 VDC, 30 M or more (ambient humidity of 70 % RH or less)
		Input terminal - chassis		500 VDC, 30 M or more(ambient humidity of 70 % RH or less)
	Withstand voltage	Primary - input terminal		No abnormalities at 1500 VAC for 1 minute.
		Primary - chassis		No abnormalities at 1500 VAC for 1 minute.
	Accessories			Setup Guide, Quick Reference (1 each for English and Japanese), CD-R (Contains the User's Manual and the Communication Interface Manual), Power cord, Set of screws for the load input terminal (2 sets.), Load input terminal cover, Screws for the Input terminal cover (2 pcs.), Protection dummy plug for J1 terminal, Connecting cable to the chassis
	Safety *14			Conforms to the requirements of the following directive and standard. Low Voltage Directive 2006/96/EC, EN61010-1:2001 Class I Pollution degree 2
	Weight			Approx. 8.0 kg
	Dimensions (Max.)			214.5(8.45")W×124(155)(4.88")H×400(455)(15.75")D mm

*1 Minimum voltage at which the current starts flowing to the electronic load. At the load input terminal.
*2 In the M range, it applies for the full scale of the H range
*3 Vin : Input terminal voltage or the sensing voltage of the electronic load.
*4 When the input voltage is varied from 0.3 V to 30V at a current of the rated power/30 V
*5 Measurement frequency bandwidth : 10 Hz to 1 MHz
*6 Measurement frequency bandwidth : 10 Hz to 20 MHz
*7 Conversion rate of the input current. At the sensing terminal.
*8 set=Vin/Rset
*9 With respect to a change in the current of 10 % to 100 % of the rating at an input voltage of 0.3 V (during remote sensing)
*10 The minimum time width is 2 µs. Between 5 kHz to 50 kHz, the maximum duty cycle is limited by the minimum time width.
*11 Time to reach from 10 % to 90 % when the current is varied from 2 % to 100 % (20 % to 100 % in M range)
*12 Time to reach from 10 % to 90 % of the input current
*13 Approximately 35 A for the input voltage of AC100 V
*14 This product is categorized in the "Class I".
The protective conductor terminal of this product must be connected to the ground.
The safety can not be guaranteed when it is not connected to the ground properly.
*15 In a mode other than CP mode
*16 In CP mode

Multifunctional Electronic Load (CC/CV/CR/CP)

PLZ-4WH Series

GPIB RS-232C USB DRIVERS CE

NEW

High-Voltage Electronic Load 650 V! For EV and HEV high-voltage converters. With the booster, extended capacity at a low cost can be realized!

In recent years, the market trend of various devices that compose in the automotive electronics such as EV, HEV, and the new energy market for PV power generation, fuel cells, secondary batteries have been moved to higher voltage and larger capacities. At the same time, it has increased the demand for the Electronic Load evaluation equipment to meet these new requirement. The PLZ-4WH Series continues to provide excellent operability of the conventional model (PLZ-4W Series) while extending the maximum operating voltage to 650 V. Furthermore, when a booster unit (PLZ2004WHB) is connected, up to 9 kW/450 A can be realized with less space and at a low cost. The interface, USB, GPIB, and RS-232C functions comes as standard and supports automated testing applications.

Dimensions

Type I : 214.5(8.44″)W × 124(4.88″)H × 400(15.75″)Dmm
Type II: 429.5(16.91″)W × 128(5.04″)H × 400(15.75″)Dmm

Accessories

Setup Guide, Quick Reference (1 each for English and Japanese), CD-R(Contains the User's Manual and the Communication Interface Manual), Power cord (with plug, length: 2.4 m), Load input terminal cover, Lockplate for the load input terminal cover (2 pcs.), Set of screws for the load input terminal (2 sets.)

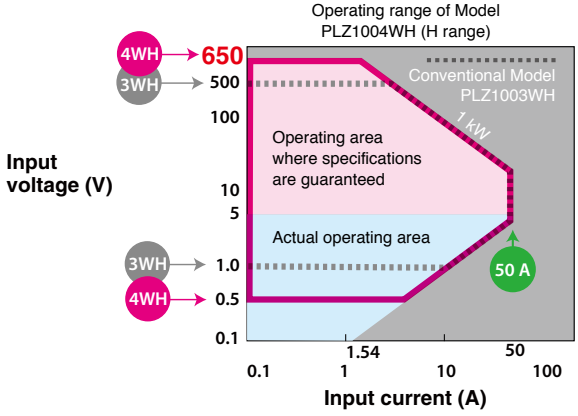
Features

- Maximum operating voltage: 650 V
- With connecting boosters, maximum of 9 kW/450 A
- 6 operation modes (CC, CR, CV, CP, CC+CV, CR + CV)
- Voltage monitor terminal for monitoring high voltage
- Sequence function (up to 1024 steps)
- Remote sensing function
- Soft start function
- Equipped with various types of protection circuits:
  Over Voltage Protection(OVP), Over Current Protection(OCP), Over Power Protection(OPP), Over Heat Protection(OHP), Under Voltage Protection(UVP), And Reverse Connection Protection(REV)
- GPIB/RS232C/USB are standard interface

Functions

■ Operating range up to 650 V

The PLZ-4WH supports input voltages of up to 650 V, and it can be used to evaluate EV and HEV in-vehicle chargers, DC/DC converters, and battery cells; evaluate power supplies for high-voltage DC electric supply systems; perform PFC tests on European and other three-phase 400 V system input power supplies; and evaluate and test high-voltage parts related to such equipment. Moreover, it achieves to enlarge further operating range. (See the figure below.) It can operate from 5 V, and even if the current is more than 0.5 V and less than 5 V, it can be used with reduced current.



▲ Comparison with our conventional PLZ-3WH (PLZ1003WH) model

■ Booster unit PLZ2004WHB*

By connecting the maximum of four PLZ2004WHB boosters (sold separately) to the PLZ1004WH, it is possible to use the product as an Electronic Load unit for up to 9 kW/450 A. Compared to parallel operation of the same model, size (space) reductions of up to about 30 %, can be achieved. Incidentally, optional PC01-PLZ-4W and PC02-PLZ-4W parallel operation cables will be required for connections depend on the number of units to be connected.

■ Specifications
Operating voltage……5 V to 650 V
Current……100 A
Power……2000 W
Input voltage……100 VAC to 240 VAC (90 VAC to 250 VAC) single phase, continuous
Power consumption……200 VA(max)
Dimensions……Type II (The depth is 550(600) mm)
Weight……approx. 24 kg

*Exclusively used for the PLZ1004WH.
It can not be used to connect any other model.

Functions

■ Low range (1/100) feature

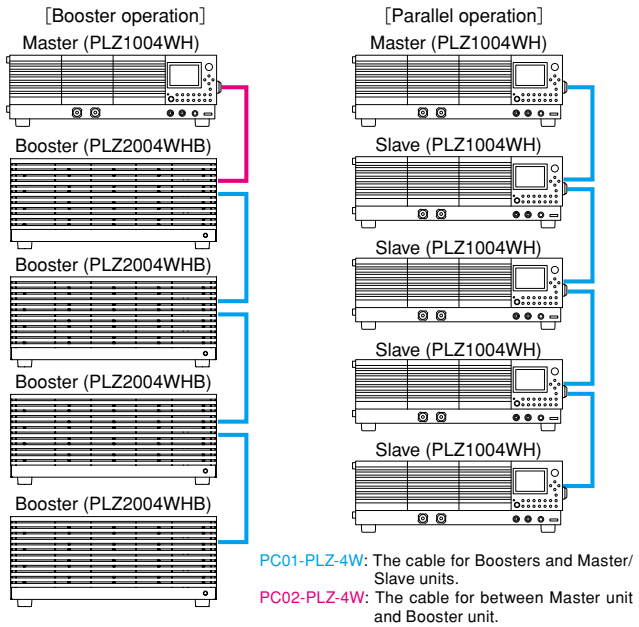
In CC, CR, and CP modes, three ranges are available: H, M, and L.
The L range is 1/100, enabling coverage from low to high power with a single unit.

● Current setting resolution

	PLZ164WH	PLZ334WH	PLZ1004WH
H	300 µA	1 mA	2 mA
M	30 µA	100 µA	200 µA
L	3 µA	10 µA	20 µA

■ Parallel operation

Parallel operation without the use of boosters is also possible up to five units of the same model, including the master unit, can be connected in parallel (5 kW/250 A maximum). In this case, the system operates under the master-slave configuration, and the master unit controls and displays the entire system. Note that optional PC01-PLZ-4W parallel operation cables will be required for connections depend on the number of units to be connected.



PC01-PLZ-4W: The cable for Boosters and Master/Slave units.
PC02-PLZ-4W: The cable for between Master unit and Booster unit.

Options

■ Accessory Kit

OP01-PLZ-4W
(used for the connection of J1 connector on the rear panel when operating by external control)
● Connector, Semi-cover, Pin 20 pcs.

■ Parallel Operation Cable

PC01-PLZ-4W
(for boosters and master/slave units, 300 mm)

PC02-PLZ-4W
(for between master unit and booster unit, 550 mm)

■ Sequence Creation Software

Wavy for PLZ-4W

PLZ2004WHB Specifications

Model		PLZ2004WHB
Ratings		
Operating voltage		5 V to 650 V
Current		100 A
Power		2000 W
Minimum operating voltage*1		0.5 V
Input resistance when load-off		2.21[MΩ]*2
Constant Current (CC) mode		
Operating range	H range	0 to 100 A
	M range	0 to 10 A
	L range	0 to 1 A
Setting range	H range	0 to 105 A
	M range	0 to 10.5 A
	L range	0 to 1.05 A
Resolution*1	H range	10 mA
	M range	1 mA
	L range	0.1 mA
Setting accuracy*2	H, M, L range	±(1.2 % of set + 1.1 % of f.s*3)
Ripple*2	H, M, L range	PLZ1004WH unit specifications × (Total power capacity/kW) (typ)
Constant resistance (CR), constant voltage (CV), and constant power (CP) mode setting accuracy		
CR mode	H, M, L range	±(1.2 % of set + 1.1 % of f.s*1)(TYP)
CV mode	H, L range	±(0.2 % of set + 0.2 % of f.s)(TYP)
CP mode	H, M, L range	±(5 % of f.s*1) 23 °C±5 °C(TYP)
Measurement functions		
Voltmeter	Accuracy H, L range	±(0.1 % of rdng + 0.1 % of f.s)(TYP)
Ammeter	Accuracy H, M, L range	±(1.2 % of rdng + 1.1 % of f.s*1)(TYP)
Wattmeter		Displays the product of the values indicated by the voltmeter and ammeter
Protective functions *1		
Overheat protection (OHP)		Load-off when heat sink temperature reaches 90 °C Load-off at time of detection
Reverse connection protection (REV)		Protection by fuse

*1 Minimum voltage when current starts to flow to the unit. Occurs at the load input terminal.
*2 In a condition in which the master unit (PLZ1004WH) is connected.

*1 When one PLZ2004WHB unit is connected
*2 When connected to master unit
*3 Full scale of range, with M range being full scale of H range

*1 M range: full scale of H range

*1 Other protective functions detect and operate with the PLZ1004WH.

Model		PLZ2004WHB
General specifications		
Input voltage range		100 Vac to 240 Vac (90 Vac to 250 Vac) single phase, continuous
Input frequency range		47 Hz to 63 Hz
Power consumption		200 VAmax
Inrush current*1		120 Amax
Protective conductor current		600 µA (typical: 100 V, 50 Hz)
Operating temperature range		0 °C to 40 °C
Operating humidity range		20 % to 85 % rh (no condensation)
Storage temperature range		-20 °C to 70 °C
Storage humidity range		90 % rh or less (no condensation)
Ground voltage		±750 Vdc
Insulation resistance	Primary to input terminal	1000Vdc, 30 MΩ or more (ambient temperature with 70 % rh or less)
	Primary to chassis	1000Vdc, 30 MΩ or more (ambient temperature with 70 % rh or less)
	Input terminal to chassis	1000Vdc, 30 MΩ or more (ambient temperature with 70 % rh or less)
Withstand voltage	Primary to input terminal	1500 V Vac, no abnormality for one minute
	Primary to chassis	1500 V Vac, no abnormality for one minute
	Input terminal to chassis	1000 V Vdc, no abnormality for one minute
Dimensions (mm) / weight		See the outline drawing. /Approx. 24 kg (52.91 lb.)
Accessories		One power cord (2.4 m length with SVT3 18AWG 3P plug), one load input terminal cover, two lock plates for load input terminal cover, two screw sets for load input terminal, and one instruction manual
Electromagnetic compatibility*2		Compatibility with these standards: Immunity IEC61326-1:2006 Class A Emission IEC61326-1:2006 Class A IEC61000-3-2:2006+A1:2009+A1:2009 IEC61000-3-3:2008
Safety*3		Compatibility with these standards: Low Voltage Directive 2006/95/EC EN61010-1:2001

*1 Approximately 60 A with 100 Vac input
*2 Applies only to models that display CE marking on panel. Does not apply to specially ordered or modified items.
*3 This product is a Class 1 instrument. Be sure to ground this product's protective conductor terminal. If it is not properly grounded, safety cannot be guaranteed.

PLZ164WH / PLZ334WH / PLZ1004WH Specifications

Model			PLZ164WH	PLZ334WH	PLZ1004WH
Ratings					
Operating voltage			5 V to 650 V		
Current			8.25 A	16.5 A	50 A
Power			165 W	330 W	1000 W
Minimum operating voltage*1			0.5 V		
Load-off input resistance			2.21(MΩ)*2		

*1 Minimum voltage when current starts to flow through the unit. Occurs at the load input terminal.
*2 When doing parallel operation with same model: 2.21/number of units [MΩ]. When doing parallel operation with PLZ2004WHB: 2.21 [MΩ].

Model			PLZ164WH	PLZ334WH	PLZ1004WH
Constant Current (CC) mode					
Operating range	H range		0 to 8.25 A	0 to 16.5 A	0 to 50 A
	M range		0 to 825 mA	0 to 1.65 A	0 to 5 A
	L range		0 to 82.5 mA	0 to 165 mA	0 to 500 mA
Setting range	H range		0 to 8.6625 A	0 to 17.325 A	0 to 52.5 A
	M range		0 to 866.25 mA	0 to 1.7325 A	0 to 5.25 A
	L range		0 to 86.625 mA	0 to 173.25 mA	0 to 525 mA
Resolution	H range		300 µA	1 mA	2 mA
	M range		30 µA	100 µA	200 µA
	L range		3 µA	10 µA	20 µA
Setting accuracy	H, M range		±(0.2 % of set + 0.1 % of f.s*1)		
	L range	At least 300 µA	±(0.2 % of set + 0.1 % of f.s)		
		Less than 300 µA	±(0.2 % of set + 0.1 % of f.s) + Vin*2/2.21 [MΩ]		
	Parallel operation		±(1.2 % of set + 1.1 % of f.s*1)		
Input voltage variation*3	H, M range		20 mA		
	L range		2 mA		
Ripple	rms*4		2 mA	4 mA	12 mA
	p-p*5		20 mA	40 mA	120 mA
	Parallel operation (typ)	rms*4	When doing parallel operation with same model: Single unit specifications x Number of units. When doing parallel operation with PLZ2004WHB: PLZ1004WH single unit specifications x (Total power capacity/kW)		
		p-p*5			

*1 Full scale of range, with M range being full scale of H range
*2 Vin: The voltage at the load input or sensing terminals
*3 When the input voltage is changed from 5 V to 650 V at a current equal to the rated power/650 V
*4 Measurement frequency bandwidth: 10 Hz to 1 MHz
*5 Measurement frequency bandwidth: 10 Hz to 20 MHz

Model		PLZ164WH	PLZ334WH	PLZ1004WH
Constant Resistance (CR) mode				
Operating range*1	H range	1.65 S to 30 µS	3.3 S to 60 µS	10 S to 200 µS
		(606.06 mΩ to 33.333 kΩ)	(303.03 mΩ to 16.666 kΩ)	(100 mΩ to 5 kΩ)
	M range	165 mS to 3 µS	330 mS to 6 µS	1 S to 20 µS
		(6.06 Ω to 333.333 kΩ)	(3.03 Ω to 166.666 kΩ)	(1 Ω to 49.999 kΩ)
	L range	16.5 mS to 0.3 µS	33 mS to 0.6 µS	100 mS to 2 µS
		(60.606 Ω to 3.333 MΩ)	(30.303 Ω to 1.666 MΩ)	(10 Ω to 500 kΩ)
Setting range	H range	1.7325 S to 0 S	3.465 S to 0 S	10.5 S to 0 S
		(577.2 mΩ to OPEN)	(288.6 mS to OPEN)	(95.23 mΩ to OPEN)
	M range	173.25 mS to 0 S	346.5 mS to 0 S	1.05 S to 0 S
		(5.772 Ω to OPEN)	(2.886 Ω to OPEN)	(952.3 mΩ to OPEN)
	L range	17.325 mS to 0 S	34.65 mS to 0 S	105 mS to 0 S
		(57.72 Ω to OPEN)	(28.86 Ω to OPEN)	(9.523 Ω to OPEN)
Resolution	H range	30 µS	60 µS	200 µS
	M range	3 µS	6 µS	20 µS
	L range	0.3 µS	0.6 µS	2 µS
Setting accuracy*2	H, M range	±(0.5 % of set*3 + 0.5 % of f.s*4)		
	L range	±(0.5 % of set*3 +0.5 % of f.s) + Vin*5/2.21 [MΩ]		
	Parallel operation (typ)	±(1.2 % of set +1.1 % of f.s*4)		

*1 Conductance [S] = Input current [A]/Input voltage [V] = 1/Resistance [Ω]
*2 Converted value with input current; at sensing terminal
*3 set=Vin/Rset
*4 When M range: Full scale of H range
*5 Vin: Rear load input terminal voltage or sensing terminal voltage

Model			PLZ164WH	PLZ334WH	PLZ1004WH
Constant Voltage (CV) mode					
Operating range	H range		5 V to 650 V		
	L range		5 V to 65 V		
Setting range	H range		0 V to 682.5 V		
	L range		0 V to 68.25 V		
Resolution	H range		20 mV		
	L range		2 mV		
Setting accuracy*1			±(0.2 % of set + 0.2 % of f.s)		
	Parallel operation (typ)		±(0.2 % of set + 0.2 % of f.s)		
Input current fluctuation*2			65 mV		

*1 At sensing terminal during remote sensing when input voltage is within operating range. Same with parallel operation, too.
*2 With respect to change in current at 10 % to 100 % of rated voltage with input voltage of 5 V (during remote sensing).

Model			PLZ164WH	PLZ334WH	PLZ1004WH
Constant Power (CP) mode					
Operating range	H range		16.5 W to 165 W	33 W to 330 W	100 W to 1000 W
	M range		1.65 W to 16.5 W	3.3 W to 33 W	10 W to 100 W
	L range		0.165 W to 1.65 W	0.33 W to 3.3 W	1 W to 10 W
Setting range	H range		0 W to 173.25 W	0 W to 346.5 W	0 W to 1050 W
	M range		0 W to 17.325 W	0 W to 34.65 W	0 W to 105 W
	L range		0 W to 1.7325 W	0 W to 3.465 W	0 W to 10.5 W
Resolution	H range		10 mW	20 mW	100 mW
	M range		1 mW	2 mW	10 mW
	L range		0.1 mW	0.2 mW	1 mW
Setting accuracy	H, M range		±(3 % of f.s*1)		
	L range	At least 0.25 W	±(3 % of f.s)		
		Less than 0.25 W	±(3 % of f.s + Vin*2/2.21 [MΩ])		
	Parallel operation(TYP)		±(5 % of f.s*1) (at 23 °C±5 °C)		

*1 When M range: Full scale of H range
*2 Vin: Rear load input terminal voltage or sensing terminal voltage

Model			PLZ164WH	PLZ334WH	PLZ1004WH
Voltmeter					
Display	H range		0.00 V to 650.00 V		
	L range		0.000 V to 65.000 V		
Accuracy	Parallel operation(TYP)		±(0.1 % of rdng + 0.1 % of f.s)		

Model			PLZ164WH	PLZ334WH	PLZ1004WH
Voltmeter					
Display	H, M range		0.0000 A to 8.2500 A	0.000 A to 16.500 A	0.00A to 50.000A
	L range		0.000 mA to 82.500 mA	0.00m A to 165.00 mA	0.00 mA to 500.00mA
Accuracy	H, M, L range		±(0.2 % of rdng + 0.3 % of f.s*1)		
	Parallel operation		±(1.2 % of rdng + 1.1 % of f.s*1)		

*1 When M range: Full scale of H range

Model			PLZ164WH	PLZ334WH	PLZ1004WH
Wattmeter					
Display *1	H, M range		0.00 W to 165.00 W	0.00 W to 330.00 W	0.0 W to 1000.0 W
	L range	Other than CP mode	0.000 W to 53.625 W	0.00 W to 107.25 W	0.0 W to 325.00 W
		CP mode	0.0000 W to 1.6500 W	0.0000 W to 3.3000 W	0.000 W to 10.000 W

*1 Displays the product of the voltage and current display values

Model		PLZ164WH	PLZ334WH	PLZ1004WH
Switching mode				
Operating mode		CC and CR		
Duty cycle settings		5 % to 95 %*1 0.1% steps		
Frequency setting range		1 Hz to 4 kHz		
Frequency setting resolution	1 Hz to 10 Hz	0.1 Hz		
	10 Hz to 100 Hz	1 Hz		
	100 Hz to 1 kHz	10 Hz		
	1 kHz to 4 kHz	100 Hz		
Frequency setting accuracy		±(0.5 % of set)		

*1 The minimum time duration is 50 µs. From 1 to 4 kHz, the maximum duty cycle is limited by it.

Model		PLZ164WH	PLZ334WH	PLZ1004WH
Slew rate				
Setting range*1	H range	0.132 mA/µs to 0.132 A/µs	0.264 mA/µs to 0.264 A/µs	0.8 mA/µs to 0.8 A/µs
	M range	13.2 µA/µs to 13.2 mA/µs	26.4 µA/µs to 26.4 mA/µs	80 µA/µs to 80 mA/µs
	L range	1.32 µA/µs to 1.32 mA/µs	2.64 µA/µs to 2.64 mA/µs	8 µA/µs to 8 mA/µs
Resolution (Setting range)	H range	50 µA(13.2 to 132 [mA/µs])	100 µA(26.4 to 264 [mA/µs])	300 µA(80 to 800 [mA/µs])
		5 µA(1.32 to 13.2 [mA/µs])	10 µA(2.64 to 26.4 [mA/µs])	30 µA(8 to 80 [mA/µs])
		0.5 µA(0.132 to 1.32 [mA/µs])	1 µA(0.264 to 2.64 [mA/µs])	3 µA(0.8 to 8 [mA/µs])
	M range	5 µA(1.32 to 13.2 [mA/µs])	10 µA(2.64 to 26.4 [mA/µs])	30 µA(8 to 80 [mA/µs])
		0.5 µA(0.132 to 1.32 [mA/µs])	1 µA(0.264 to 2.64 [mA/µs])	3 µA(0.8 to 8 [mA/µs])
		0.05 µA(13.2 to 132 [µA/µs])	0.1 µA(26.4 to 264 [µA/µs])	0.3 µA(80 to 800 [µA/µs])
	L range	0.5 µA(0.132 to 1.32 [mA/µs])	1 µA(0.264 to 2.64 [mA/µs])	3 µA(0.8 to 8 [mA/µs])
		0.05 µA(13.2 to 132 [µA/µs])	0.1 µA(26.4 to 264 [µA/µs])	0.3 µA(80 to 800 [µA/µs])
		0.005 µA(1.32 to 13.2 [µA/µs])	0.01 µA(2.64 to 26.4 [µA/µs])	0.03 µA(8 to 80 [µA/µs])
Setting accuracy*2		±(10 % of set + 25 µs)		

*1 In constant current mode. In constant resistance mode, the maximum slew rate in each range is 1/10.
*2 Time to reach 10 % to 90 % with respect to a 2 % to 100 % (or for M range a 20 % to 100 %) change from the rated current.

PLZ164WH / PLZ334WH / PLZ1004WH Specifications

Model		PLZ164WH	PLZ334WH	PLZ1004WH
Soft start				
Operating mode		CC mode		
Time setting range*1		1, 2, 5, 10, 20, 50, 100, 200 ms		*1 Time for input current to reach 10 % to 90 %
Time setting accuracy		±(30 % of set + 100 µs)		
Response				
Response speed	CC/CR mode	Switchable in 4 stages (1/1, 1/2, 1/5, 1/10)		
	CV mode	Switchable in 5 stages (100, 10, 1, 1/10, 1/100)		
Remote sensing				
Voltage that can be compensated	One way	2 V		
Protective functions				
Overvoltage protection (OVP)		110 % of rated voltage for the range		
Overcurrent protection (OCP)		110 % of 0.01 A rated current or 110 % of the maximum current for each range: Load-off or limit selectable		
Overpower protection (OPP)		From 0.1 % to 110 % of rated power or 110 % of the maximum power of each range: Load-off or limit selectable		
Overheat protection (OHP)		Load-off when heat sink temperature reaches 90 °C		
Undervoltage detection (UVP)		Can set to Off, 5 V to 650 V		
Reverse connection protection (REV)		By fuse. Load-off when ALM occurs.		
Sequence functions				
Normal sequence	Operating modes	CC, CR, CV, CP		
	Maximum steps	256		
	Step execution time	1 ms - 999 h 59 min		
	Time resolution (setting range)	1 ms (1 ms to 1 min), 100 ms (1 min to 1 h), 1 s (1 h to 10 h), 10 s (10 h to 100 h), 1 min (100 h to 999 h 59 min)		
Fast sequence	Operating mode	CC, CR		
	Maximum steps	1024		
	Step execution time	100 µs to 100 ms		
	Time resolution	100 µs		
Other				
Elapsed time display		Measurement of time from load-on to load-off, On/Off capable 1 s to 999 h 59 min 59 s		
Auto load-off timer		Automatic load-off after elapse of preset time. Can set from 1 s to 999 h 59 min 59 s or to Off.		
Analog external control (EXT CONT connector)				
Load-on/off control input		Switchable logic level, pull-up to 5 V at 10 kΩ (CMOS level signal)		
External range switching input*1		2 bit, pull-up to 5 V at 10 kΩ (CMOS level signal)		
Trigger input		Clear the sequence operation pause when at least 10 µs are input for H (CMOS level signal for 5 V system), pull-down to common by 100 kΩ resister		
External alarm input		Alarm operation with L, pull-up to 5 V at 10 kΩ (CMOS level signal)		
Alarm status output		During alarm (OVP, OCP, OPP, OHP, REV) operation and external alarm input: On, open collector (photocoupler)*2		
Load-on status output		During load-on: On, open collector (photocoupler)*2		
Range status output		2 bit, open collector (photocoupler)*2		
Short signal		Relay contact output (30 Vdc/1 A)		
External voltage control input (CC, CR, CV, CP modes)		CC, CR, CV, and CP modes. 0 to 100 % of rated current, voltage, and power at 0 to 10V (CC, CV, CP). Maximum to minimum resistance at 0 to 10 V (CR).		
External resistance control input (CC, CR, CV, CP modes)		0 to 100 % or 100 to 0 % of rated current, voltage, and power at 0 to 10 kΩ (CC, CV, CP). Maximum to minimum resistance or minimum to maximum resistance at 0 to 10 kΩ (CR).		
External CV voltage control input		0 to 10 % of rated voltage at 0 to 10 V		
Current monitor output		10 V f.s. (H/L range), 1 V f.s. (M range), output impedance of 1 kΩ		
Voltage monitor output		10 V for each range f.s., output impedance of 1 kΩ		
Front BNC terminal				
Trigger output		Output of pulse during sequence operation, switching operation, or GPIB GET command input		
Current monitor output		10 V for full scale (H/L range), 1 V for full scale (M range)		
Voltage monitor output		6.5 V for full scale in each range		
Communication functions				
GPIB		IEEE std. 488.1-1987 SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E1 Supports SCPI and IEEE std. 488.2-1992 specification command set.		
RS232C		D-SUB 9pin (EIA-232-D)Baud rate: 2400/4800/9600/19200 bps; Data bit: 8; Stop bit: 1/2; Parity: none; Flow control: Xon/Xoff. Supports SCPI and IEEE std. 488.2-1992 specification command set.		
USB		USB 2.0, 12 Mbps. Conforms to USBTMC-USB488 device class.		

*1 Front panel settings are only effective in the H range. *2 Photocoupler's maximum applied voltage is 30 V and maximum current is 8 mA.
*3 External CV voltage control input cannot be used in CP or CV mode.

Model		PLZ164WH	PLZ334WH	PLZ1004WH
General specifications				
Input voltage range/input frequency range		100 to 240 Vac (90 to 250 Vac) single phase, continuous: 47-63 Hz		
Power consumption		80 VAmax	90 VAmax	160 VAmax
Inrush current *1		140 Amax		
Protective conductor current (when at 100 V, 50 Hz: typical value)		600 µA		
Operating temperature range/humidity range		0 ° to 40 °C, 20 % to 85 % rh (no condensation)		
Storage temperature range/humidity range		-20 ° to 70 °C, 90 % rh or less (no condensation)		
Ground voltage		±750 Vdc		
Insulation resistance	Primary to input terminal	1000 Vdc, 30 MΩ or more (ambient temperature with 70 % rh or less)		
	Primary to chassis	1000 Vdc, 30 MΩ or more (ambient temperature with 70 % rh or less)		
	Input terminal to chassis	1000 Vdc, 30 MΩ or more (ambient temperature with 70 % rh or less)		
Withstand voltage	Primary to input terminal	1500 V Vac no abnormality for one minute		
	Primary to chassis	1500 V Vac no abnormality for one minute		
	Input terminal to chassis	1000 V Vdc no abnormality for one minute		
Dimensions (mm)		See the outline drawing.		
Weight		Approx. 7 kg (15.4 lb.)	Approx. 8 kg (17.6 lb.)	Approx. 16 kg (35.3 lb.)
Battery backup		Backs up configuration (setting) information		
Accessories		Power cord (2.4 m length with SVT3 18AWG 3 P plug): 1 pc., Load input terminal cover: 1pc., Lock plates for load input terminal cover: 2 pc., Screw sets for load input terminal: 2 pc., CD-R *2: 1 pc., Setup guide (Japanese/English): 1 pc., Quick reference in Japanese: 1 pc., Quick reference in English: 1 pc.		
Electromagnetic ompatibility *3		Compatibility with these standards: Immunity IEC61326-1:2006 Class A Emission IEC61326-1:2006 Class A IEC61000-3-2:2006+A1:2009+A1:2009 IEC61000-3-3:2008		
Safety *4		Compatibility with these standards: Low Voltage Directive 2006/95/EC EN61010-1 2001		

*1 Approximately 70 A with 100 Vac input *2 CD-R contains application and sample, user's manual, communication interface manual, and VISA library (KI-VISA).
*3 Applies only to models that display CE marking on panel. Does not apply to specially ordered or modified items.
*4 This product is a Class 1 instrument. Be sure to ground this product's protective conductor terminal. If it is not properly grounded, safety cannot be guaranteed.

Multifunctional Electronic Load (CC/CV/CR/CC+CV/CR+CV)

PLZ-U Series

GPIB RS-232C DRIVERS CE

This photo shows a 5-channel frame housing 5 units.
The rack mount bracket is optional.

*Multi-Channel Load Systems Can Be Built Easily! Operating Multiple Units in Parallel Offers Large Capacity!**

The PLZ-U Series provides a set of compact, high-performance multi-channel electronic load systems capable of operating in three modes - constant current, constant resistance, and constant voltage. Adopting the modular (plug-in) design, the Series consists of four models - two frame models and two load unit models. The PLZ-30F frame can house load units to support up to three channels, and the PLZ-50F frame up to five channels. The available two load unit models are 70UA (75-watt load that operates even at 0 V) and 150U (150-watt load that operates from 1.5 V up). Load units can be operated in parallel to increase the current capacity or power capacity. By combining different models of load units and frame, the power capacity can be changed from 75 W to 750 W (when five PLZ150U units are mounted in a PLZ-50F frame). Supporting the GPIB and RS-232C interfaces as standard, the electronic load can be built into various types of test systems, making it useful in testing fuel cells, secondary cells, DC/DC converters, switching power supplies, multiple-output power supplies, and more.

* Only load units of the same model can be operated in parallel.

Dimensions

PLZ-30F: 292(11.5″)W × 128(5.04″)H × 400(15.75″)Dmm
PLZ-50F: 435(17.13″)W × 128(5.04″)H × 400(15.75″)Dmm

Features

- Slew rate of 2.4 A/μs in the rising and falling edges in CC mode (PLZ150U)
- Built-in three ranges; voltmeter, ammeter, and wattmeter functions that provide readings of up to five digits
- The current slew rate can be changed continuously in constant current and constant resistance modes.
- Supports 0-V input - an indispensable feature for testing single-cell fuel cells.
- Individual units (channels) can operate either independently or in synchronization.
- Up to five load units of the same model can be operated in parallel.
- Up to three values can be stored in memory for each most frequently used operation mode and range.
- Equipped with various types of protection circuits (over voltage protection, over current protection, over power protection, over heat protection, under voltage protection, and reverse connection protection).
- Supports the GPIB and RS-232C interfaces as standard.
- External control is available to turn on or off the output.

Accessories

Load unit: Operation manual, Rear load input terminal cover, Load input connector screw set (2 sets/M6 bolt, M6 nut, M6 spring washer and M4 screw), Load unit attachment screw (2 pcs./M3-10 screw), Sensing terminal screw (2 pcs./M3-6 screw, attached to the unit)
Frame: Operation manual, Power cord (with SVT3 18AWG 3-prong plug, cable length of 2.4 m), Front/Rear blank panel (2 pcs./PLZ-30F or 4 pcs./PLZ-50F), Protection dummy plug (2 pcs./for the FRAME CONT connector, attached to the unit)

Application Software (downloadable free of charge)

Application software for controlling this system from a PC is available from our website.

[NOTICE]PLZ-70UA

The operating voltage is guaranteed by the input terminal of the load unit. Be sure to select a load cable that never inputs a voltage of 0 V or less to the load unit input terminal. This system detects the no-signal condition. The no-signal condition is detected when the voltage at the load unit input terminal is 0.3 V or less and when the input current is equal to or less than about 1 % of the rating, in which case the current will stop flowing.

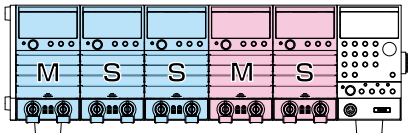
Options

■ Control Flat Cable
PC01-PLZ-4W (300 mm)
PC02-PLZ-4W (550 mm)
(for connection between frames)

■ Sequence Creation Software
Wavy for PLZ-U

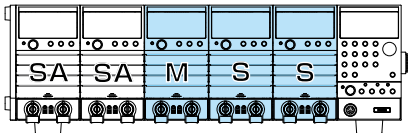
Parallel Operation for Larger Capacity

Up to five adjacent load units of the same models can be operated in parallel. For example, you can build a 375-watt load system by operating five PLZ70UA load units in parallel in the PLZ-50F frame or a 750-watt load system by operating five PLZ150U load units in parallel.



M: Master
S: Slave

When three load units of one model and two load units of another model are operated in parallel in the PLZ-50F frame



M: Master
S: Slave
SA: Standalone load unit

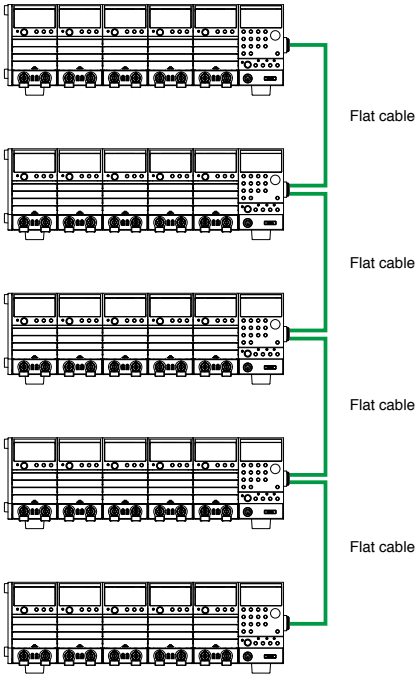
When three load units of the same model are operated in parallel and two standalone load units are operated independently in the PLZ-50F frame

Number of Modules and Capacities

Number of parallel operated load modules	PLZ70UA	PLZ150U
2	30 A/150 W	60 A/300 W
3	45 A/225 W	90 A/450 W
4	60 A/300 W	120 A/600 W
5	75 A/375 W	150 A/750 W

Frame Control

By connecting two or more frames, you can use one frame to control the other frames (up to five frames can be connected at a time). Operations such as load on/off and preset memory call can be performed.



Ordering code * Please inquire by following code

Model name	Frame model	PLZ70UA	PLZ150U	Total number of unit
PLZ30F-70UA0-150U1	PLZ-30F	0	1	1
PLZ30F-70UA0-150U2		0	2	2
PLZ30F-70UA0-150U3		0	3	3
PLZ30F-70UA1-150U0		1	0	1
PLZ30F-70UA1-150U1		1	1	2
PLZ30F-70UA1-150U2		1	2	3
PLZ30F-70UA2-150U0		2	0	2
PLZ30F-70UA2-150U1		2	1	3
PLZ30F-70UA3-150U0		3	0	3

Model name	Frame model	PLZ70UA	PLZ150U	Total number of unit
PLZ50F-70UA0-150U1	PLZ-50F	0	1	1
PLZ50F-70UA0-150U2		0	2	2
PLZ50F-70UA0-150U3		0	3	3
PLZ50F-70UA0-150U4		0	4	4
PLZ50F-70UA0-150U5		0	5	5
PLZ50F-70UA1-150U0		1	0	1
PLZ50F-70UA1-150U1		1	1	2
PLZ50F-70UA1-150U2		1	2	3
PLZ50F-70UA1-150U3		1	3	4
PLZ50F-70UA1-150U4		1	4	5
PLZ50F-70UA2-150U0		2	0	2
PLZ50F-70UA2-150U1		2	1	3
PLZ50F-70UA2-150U2		2	2	4
PLZ50F-70UA2-150U3		2	3	5
PLZ50F-70UA3-150U0		3	0	3
PLZ50F-70UA3-150U1		3	1	4
PLZ50F-70UA3-150U2		3	2	5
PLZ50F-70UA4-150U0		4	0	4
PLZ50F-70UA4-150U1		4	1	5
PLZ50F-70UA5-150U0		5	0	5

PLZ-U Series Specifications

Model			PLZ150U	PLZ70UA
Rating				
Operating voltage (DC)			1.5 V to 150 V	0 V to 150 V
Current/power	Range	H	30 A/150 W	15 A/75 W
		M	3 A/150 W	1.5 A/75 W
		L	300 mA/45 W	150 mA/22.5 W
Isolation voltage of the load input terminal			500 VDC	
Withstand voltage between load input terminal channels			500 VDC	
Minimum start voltage*1			0.3 V or greater	
CC mode				
Operating range	Range	H	0 A to 30 A	0 A to 15 A
		M	0 A to 3 A	0 A to 1.5 A
		L	0 A to 300 mA	0 A to 150 mA
Selectable range			0 % to 105 % of f.s	
Resolution	Range	H	2 mA	1 mA
		M	0.2 mA	0.1 mA
		L	0.02 mA	0.01 mA
Accuracy of setting	Range	H, M, and L	±(0.2 % of set + 0.2 % of f.s) + Vin*1/500 kΩ	
Input voltage variation*2	Range	H	2 mA	
		M	1 mA	
		L	0.1 mA	
Ripple		rms*3	3 mA	7.5 mA
		p-p*4	30 mA	50 mA
CR mode				
Operating range The value inside parentheses is the conductance. *1	Range	H	PLZ150U OPEN to 50 mΩ (0 S to 20 S)	OPEN to 100 mΩ (0 S to 10 S)
		M	OPEN to 500 mΩ (0 S to 2 S)	OPEN to 1 Ω (0 S to 1 S)
		L	OPEN to 5 Ω (0 S to 200 mS)	OPEN to 10 Ω (0 S to 100 mS)
Selectable range			0 % to 105 % of f.s *2	
Resolution The value inside parentheses is the operating range.	Range	H	0.2 mS (0 S to 2 S)	0.1 mS (0 S to 1 S)
			2 mS (2 S to 20 S)	1 mS (1 S to 10 S)
		M	20 μS (0 S to 200 mS)	10 μS (0 S to 100 mS)
			0.2 mS (200 mS to 2 S)	0.1 mS (100 mS to 1 S)
		L	2 μS(0 S to 20 mS)	1 μS(0 S to 10 mS)
			20 μS(20 mS to 200 mS)	10 μS(10 mS to 100 mS)
Accuracy of setting*3	Range	H, M, and L	±(0.5 % of set*4 + 0.5 % of f.s*5) + Vin/500 kΩ	
CV mode				
Operating range	Range	H	1.5 V to 150 V	0 V to 150 V
		L	1.5 V to 15 V	0 V to 15 V
Selectable range			0 % to 105 % of f.s	
Resolution	Range	H	10 mV	
		L	1 mV	
Accuracy of setting	Range	H and L	±(0.1 % of set + 0.1 % of f.s)	
Input current variation*1			12 mV	

[Rating]

*1 Minimum voltage at which the current starts flowing to the PLZ-U.
(The PLZ-U detects no signal at an input voltage less than or equal to approximately 0.3 V and an input current less than or equal to approximately 1 % of the range rating. Therefore, if the input voltage is gradually increased from 0 V, no current will flow until 0.3 V is exceeded. If a current greater than or equal to 1% of the range rating starts flowing, the current can flow at voltages less than equal to 0.3 V.)

[CC mode]

*1 Vin: Load input terminal voltage
*2 At a current greater than or equal to (Vin/500 kΩ)
*3 Measurement frequency bandwidth: 10 Hz to 1 MHz
*4 Measurement frequency bandwidth: 10 Hz to 20 MHz

[CR mode]

*1 Conductance [S] = (Input current [A]/input voltage [V]) = (1/resistance [Ω])
*2 Conductance f.s
*3 Converted value in terms of the input current, during remote sensing
*4 set = input voltage × specified conductance = (input voltage/ specified resistance)
*5 f.s = Rated current of the specified range

[CV mode]

*1 During remote sensing

PLZ-U Series Specifications

Model			PLZ150U	PLZ70UA
Voltmeter				
Measurement range			0 V to 150.0 V	
Resolution	15.75 V to 150 V		0.01 V	
	0 V to 15.75 V		0.001 V	
Measurement accuracy			±(0.1 % of rdg + 15 digits)	
Ammeter				
Measurement range	Range	H	0 A to 30 A	0 A to 15 A
		M	0 A to 3 A	0 A to 1.5 A
		L	0 mA to 300 mA	0 mA to 150 mA
Resolution	Range	H	0.001 A	
		M	0.0001 A	
		L	0.01 mA	
Measurement accuracy			±(0.2 % of rdg + 0.3 % of f.s)	
Wattmeter*1				
Measurement range			0 W to 150 W	0 W to 150 W
Resolution	100 W minimum		0.01 W	
	100 W or greater		0.1 W	
Switching mode				
Operation mode			CC and CR	
Selectable frequency range			1 Hz to 20 kHz	
Duty cycle setting			2 % to 98 %, 0.1 % steps	
Frequency resolution	1 Hz to less than 1 kHz		1 Hz	
	1 kHz to less than 10 kHz		10 Hz	
	10 kHz to 20 kHz		100 Hz	
Accuracy of frequency setting			±(0.5 % of set)	
Slew rate				
Operation mode			CC and CR	
Selectable range (CC)	Range	H	0.10 A/µs to 2.40 A/µs	0.05 A/µ to 1.20 A/µs
		M	0.10 A/µs to 0.24 A/µs	0.05 A/µ to 0.12 A/µs
		L	24 mA/µs*1	12 mA/µs*1
Selectable range (CR)	Range	H	0.10 A/µs to 0.24 A/µs	0.05 A/µ to 0.12 A/µs
		M	24 mA/µs*1	12 mA/µs*1
		L	2.4 mA/µs*1	1.2 mA/µs*1
Resolution			0.01 A/µs	
Accuracy of setting*2			±(10 % of set + 5 µs)	
Soft start				
Operation mode			CC	
Selectable time range			0.1, 1, 3, 10, 30, 100, or 300 ms	
Time accuracy			±(30 % of set +100 µs)	
Sequence function				
Sequence	Operation mode		CC and CR	
	Maximum number of steps		255	
	Step execution time		1 ms to 9 999 s	
	Number of loops		1 to 9999 (9999 is infinite loop)	

[Wattmeter]
*1 Product of the measured voltage and measured current

[Slew rate]
*1 Fixed value
*2 Time to reach from 10 % to 90 % when the current is changed from 2 % to 100 % of the rated current of H range.

PLZ-U Series Specifications

Model		PLZ150U	PLZ70UA
Protection function			
Overvoltage protection (OVP)		Turns off the load at 110 % of the rated voltage	
Overcurrent protection (OCP)		Set the value in the range of 0 % to 110 % of the rated current of H range. Trips at the value or 110 % of the rated current of the range, whichever is less. The action taken when the OCP trips can be set to load off or limit.	
Overpower protection (OPP)		Set the value in the range of 0 % to 110 % of the rated power of H range. Trips at the value or 110 % of the rated power of the range, whichever is less. The action taken when the OPP trips can be set to load off or limit.	
Overheat protection (OHP)		Trips when the heat sink temperature reaches 95 °C. The action taken when the OHP trips is to turn the load off.	
Reverse connection protection (RVP)		Short-term protection provided by a short-circuit system using a protection diode. The action taken when the OHP trips is to turn the load off.	
Undervoltage protection (UVP)		Set the value to off or in the range of 0 % to 100 % of the rated voltage. The action taken when the OHP trips is to turn the load off.	
Communication function			
GPIB		IEEE std. 488.2-1994 SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, and E1	
		Supports the SCPI command set Sets panel functions except the POWER switch and key lock and reads measured values	
RS-232C		D-SUB 9-pin connector (conforms to EIA-232-D)	
		Sets panel functions except the POWER switch and key lock and reads measured values Baud rate: 2400, 4800, 9600, or 19200 bps; stop bit: 1; data length: 8 bits; parity: NONE; and flow control: XON/OFF.	
Inter-frame control and external control			
Inter-frame control		Controls up to four slave frames from the master frame.	
		Enables you to turn on/off the load, recall presets ABC on all channels simultaneously, and recall setup memories 0 to 3.	
External control	Recall input of preset mem-ories A, B, and C	Recalls preset memories A, B, and C on all channels simultaneously	
	Setup memory recall input	Recalls the setup memory 0 to 3	
	Enable input	Enables the turning on/off of the load, recalling of presets ABC on all channels simultaneously, and recalling of setup memories 0 to 3.	
	Load-on input	Turns on the load on all channels simultaneously.	
	Load on status output	On when the load is on (open collector output)	
	Alarm status output	On when the alarm is on (open collector output)	
	Internal power output	5 V and maximum output current of 100 mA	
Input signal		Low active, pull up to 5 V using 10 kΩ. Low level input voltage: 0 V to 1 V, high level input voltage: 4 V to 5 V	
Output signal		Open collector, output withstand voltage of 30 VDC, output saturation voltage of approximately 1.1 V, and maximum output current of 100 mA.	
Remote sensing			
Sensing voltage that can be compensated		2 V for a single line	
Miscellaneous			
ABC preset memories		Saves settings (A, B, and C) for each operation mode of each range	
Setup memories		Saves four sets of setup parameters	
Elapsed time display		Measures the time from when the load is turned on to when the load is turned off (0.1 s to 99999 s)	
Auto load off timer		Turns off the load after the specified time elapses (off or 1 s to 99999 s)	
Delayed load-on		Turns on the load after the specified time elapses (0 ms to 1 s, 10 ms steps)	
Parallel operation		Possible between adjacent load units (same model) in the frame.	

PLZ-U Series Specifications

Model		PLZ150U	PLZ70UA
External analog control			
Power output		12 V and maximum output current of 50 mA.	
External voltage control input *1		Operates in CC, CR, and CV modes. 0 % to 100 % of f.s in the range of 0 V to 10 V.	
Load-on input.		Low active (or high active), pull up to 5 V using 10 kΩ. Low level input voltage: 0 V to 1 V, high level input voltage: 4 V to 5 V	
Current monitor output		0 % to 100 % of the rated current in the range of 0 V to 10 V	
Common		Negative pin electric potential of the load input terminal	
General Specifications			
Weight		Approx. 2 kg	
Accessories	Rear load input terminal cover	1 pc.	
	Set of screws for the load input connector	2 sets (M6 bolt, M6 nut, M6 spring washer, M4 screw)	
	Load unit attachment screws	2 pcs. (M3-10 screws, attached to the unit)	
	Sensing terminal screw on the rear panel	2 pcs. (M3-6 screws, attached to the unit)	

Model		PLZ30F	PLZ50F
Rated supply voltage		100 VAC to 240 VAC (90 VAC to 250 V) single phase	
Rated frequency		50 Hz or 60 Hz (47 Hz to 63 Hz)	
Power consumption	Frame alone	33 VA or less	40 VA or less
	When load units are installed in all channels	300 VAmax	500 VAmax
Cooling system		Forced air cooling using a heat sensing variable speed fan.	
Operating temperature range		0 °C to 40 °C	
Operating humidity range		20 % to 85 % RH (without condensation)	
Storage temperature range		–20 °C to 70 °C	
Storage humidity range		90 % RH or less (without condensation)	
Insulation resistance	Primary - chassis	500 VDC, 30 MΩ or more (ambient humidity of 70 % RH or less)	
Withstand voltage	Primary - chassis	No abnormalities at 1500 VAC for 1 minute.	
Ground continuity		25 Aac, 0.1 Ω or less	
Battery backup		Backs up the setup data immediately before the power is turned off Battery life: 3 years or longer (at 25 °C)	
Number of installable load modules		3	5
Dimensions (mm)		See outline drawing.	
Weight	Frame alone	Approx. 5 kg	Approx. 7 kg
Accessories	Power cord	1 pc. (with SVT3, 18AWG, 3-prong plug, cable length of 2.4 m)	
	Blank panel (front panel)	2 pcs. maximum *1	4 pcs. maximum *1
	Protection dummy plug	2 pcs. (for the FRAME CONT connector, attached to the unit)	
	Operation manual	1 pc.	
Electromagnetic compatibility *1, *2		Conforms to the requirements of the following directives and standards EMC Directive 89/336/EEC EN61326:1997/A2:2001 Emission: Class A Immunity: Minimum immunity test requirement EN61000-3-2:2000 EN61000-3-3:1995/A1:2001	
Safety *3, *4		Conforms to the requirements of the following directives and standards Low Voltage Directive 73/23/EEC EN61010-1:2001 Class I Pollution degree 2	

[External analog control]

*1 The time for updating the setting in CR or CV mode is approximately 100 ms.

*1 In products that have load units installed, blank panels are installed in the empty slots. In products that contain the frame alone, the maximum number of blank panels are installed.

*2 Only on models that have CE marking on the panel.

*3 Not applicable to custom order models.

*4 This unit is a Class 1 device. Be sure to ground the protective conductor terminal of the unit. The safety of the unit is not guaranteed unless the unit is grounded properly.

Electronic Load (AC)

PCZ1000A

RS-232C DRIVERS CE

For load test of inverters or transformers used for Fuel Cell, UPS, or Solar power generation

PCZ1000A is an AC electronic load that enables you to perform load simulation for various inverters* and transformers.
In addition to the resistive loads generally used in tests, it is capable of simulating capacitor-input rectifier loads.
The instrument supports input up to 1000 W and is equipped with 3 operation modes, Constant Current, Constant Resistance, and Constant Power.
Current waveform resemble to sine wave can be output constantly without effect by voltage waveform at each mode. Moreover, the instrument is equipped with Crest Factor function that is suitable for simulating current load test for switching power supply.
This instrument provides improved operationality through CPU control and enables external control and read-back via RS-232C.

*When the invertor circuit is used as the input source of this product, depending on the invertor waveform, it may cause a malfunction of the normal operation.

Dimensions / Weight

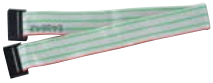
430(16.93″)W × 128(5.04″)H × 400(15.75″)Dmm /22Kg(48.5 lbs)

Accessories

Operation Manual, AC power cable, Weight seal, Fuse in different rating(2 pcs.)

Options

■ Parallel operation cable
PC01-PCZ1000A



■ Sequence Creation Software
Wavy for PCZ1000A

Features

■ Crest Factor Function
Equipped with Crest Factor function that facilitates performing load tests for peak or harmonic currents.
Crest Factor value can be set from 1.4 to 4.0.

■ As master-slave control, up to 4 slave units can be connected in parallel. (Maximum 5 kW, 50 Arms)

■ Equipped with tracking operation function
Same setting value as that of master unit will be set on slave unit. It is convenient as a single-phase 3-wire or three-phase 3-wire AC source load

PCZ1000A Specifications

Input Rating (AC)	Operating Voltage *1		14 to 280 Vrms
			20 to 400 Vpeak
	Maximum Current *2		10 Arms
			40 Apeak
	Maximum Power *3		1000 W
	Frequency		45 to 65 Hz
	Minimum Operation Starting Voltage *4		3 Vpeak
Constant Current (C.C) mode *5	Setting Range		0 to 10 Arms
	Setting Accuracy *9		Within ± (1 % of set + 0.1A)
	Setting Resolution		10 mArms
	Stability	Line variations *10	Within ±10 mArms
		Input voltage variations *11	Within ±100 mArms
	Temperature Coefficient (at rated current)		200PPM/℃ (typical)
Constant Resistance(C.R)mode *6	Setting Range	H range (Full current at 10V)	1 Ω to 1 kΩ
			1 S to 1 mS *20
		L range (Full current at 100V)	10 Ω to 10 kΩ
			0.1 S to 0.1 mS *20
	Setting Resolution	H range	1 mS *20
		L range	0.1 mS *20
	Setting Accuracy	(in current terms) *9 *12	Within ±(2 % of set + 0.2 A)
	Stability	Input voltage variations *13	Within ±10 %
Constant Power (C.P) mode *7	Setting Range		50 W to 1000 W
	Setting Accuracy *9 *14		Within ±5 % of set
	Setting Resolution		1 W
	Input voltage variations *15		Within ±5 %
Crest Factor (C.F)function *8	Setting Range		1.4 to 4.0
	Resolution		0.1
Master-slave parallel operation	Up to 5 units including master unit		
Tracking function	Same current as master unit passes to slave unit		
Ammeter (RMS display mode)	Number of display digits (full scale)		10.00 Arms
	Accuracy *9		Within ±1 % of FS
Ammeter (PEAK display mode)	Number of display digits (full scale)		40.0 Apeak
	Accuracy *9		Within ±2 % of FS
Voltmeter	Number of display digits (full scale)		300.0 Vrms
	Accuracy *9		Within ±1 % of FS
Protection function	Peak Overcurrent protection (POCP) *16		Approx. 48 Apeak
	Overcurrent protection (OCP) *17		Approx. 11.5 Arms
	Overvoltage protection (OVP) *16		Approx. 470 Vpeak
	Overpower protection (OPP) *17		Approx. 1150 W
	Overheat protection (OHP) *18		–
	Internal power element protection (FUSE BRK)		Cut off internal fuse
Input Power (AC)	Voltage range (nominal value) *19	1	90 to 110(100) Vrms
		2	108 to 132(120) Vrms
		3	180 to 220(200) Vrms
		4	216 to 250(240) Vrms
	Frequency		50/60 Hz
	Power consumption (Apparent power)		MAX220 VA
Withstanding voltage	Primary — Chassis		1500 Vac, 1 minute
	Primary — Load input terminal		1500 Vac, 1 minute
	Load input terminal — Chassis		500 Vac, 1 minute
Insulation resistances	Primary — Chassis		DC1000 V, 20 MΩ and over
	Primary — Load input terminal		DC1000 V, 20 MΩ and over
	Load input terminal — Chassis		DC1000 V, 20 MΩ and over
Temperature and humidity range	Operating temperature range		0 to 40 ℃
	Operating humidity range		20 to 85 %rh(no condensation)
	Storage temperature range		–25 to 70 ℃
	Storage humidity range		90 %RH or less(no condensation)
Dimensions(Chassis)	430 W×400 D×128 H mm		
Weight	Approx. 22 kg		

*1 Input voltage range in which rated input current can flow

*2 For an input voltage of 100 Vrms or greater, the maximum current is derated at the rated input power (1000 W)

*3 For an input voltage of 100 Vrms or less, the maximum power is limited by the rated input current (10 Arms).

*4 Minimum input voltage at which the input current starts to flow

*5 The input current waveform does not change with changes in the input voltage waveform.

The rms value of the input current is kept constant (response rate: approximately 1 s)

(Response rate: Time required to reach ±10 % of the steady value (value reached 5 seconds or more after state change))

*6 The input current waveform does not change with changes in the input voltage waveform.

This mode allows an input current (rms value) proportional to the rms value of the input voltage to flow (response rate: approximately 1 s)

*7 The input current waveform does not change with changes in the input voltage waveform.

This mode allows an input current (rms value) inversely proportional to the rms value of the input voltage to flow (response rate: approximately 1 s).

*8 Varies the angular width of the current at the approximate input voltage peak, based on the sinusoidal current waveform.

*9 At room temperature (23±5 ℃)

*10 Changes in the input current when variations in the rated voltage range are given at an inplut voltage of 100 Vrms and an input current of 10 Arms, based on the nominal value of the input line voltage.

*11 Changes in the input current when the input voltage is changed from 10 Vrms to 280 Vrms at an input current of 3.57 Arms (rating at an input voltage of 280 Vrms)

*12 At an input voltage 100 Vrms

*13 Changes in the resistance value when the input voltage is varied from 10 Vrms to 100Vrms at an input current of 0.5 A or more.

*14 At an input voltage of 100 Vrms

*15 Changes in the power value when the input voltage is varied from 10 Vrms to 100 Vrms

*16 Turns off [LOAD] KEY within 20 ms

*17 Turns off [LOAD] KEY within 3 s

*18 Detects the internal heat sink surface temperature to turn off the [LOAD] key

*19 Switching

*20 S represents unit of conductance (siemens)
Conductance [S]=1/Resistance value [Ω]
Conductance[S]× Input voltage[V]=Load current [A]

Options

■Rack mount bracket
KRB3 (Inch size,EIA standard compatible rack)
KRB150 (Metric size, JIS standard compatible rack)
■Parallel operation cable
PC01 PCZ1000A

Fuel Cell Impedance Meter

KFM2005

GPIB RS-232C USB DRIVERS CE

Possible to acquire the Tafel plot and the Cole-cole plot of the micro fuel cell (such as cellular phones, laptop computers, and electrc power-assisted bicycles, etc.)

The impedance meter KFM2005 is designed for testing of the fuel cell with the small current (5 A or less), and not only the current-voltage characteristic test, the KFM2005 can easily measure for the impedance of a fuel cell using the AC impedance method, and the Cole-Cole plot. Using the measurement data of the Cole-cole plot, it is possible to calculate the circuit constant of the approximate equivalent circuit of the fuel cell. The built-in DC load (60 W) is capable to operate from 0 V, and it can peform the test for the fuel cell up to 20 V and 5A.

Dimensions / Weight

430(16.93″)W × 88(3.47″)H × 380(14.96″)Dmm / 9.5kg(20.94 lbs)

Accessories

Operation manual, Power cord, Sensing line, Load line, Application software (CD)

Options

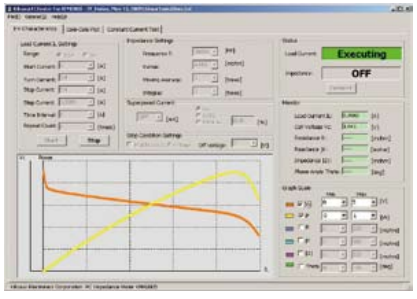
■ Rack mount bracket
KRB100-TOS (JIS standard)
KRB2-TOS (EIA standard)

Features

- Impedance of cells up to 20 V can be measured in the range of 10 mHz to 10 kHz.(The cell voltage/current can be read back as well in the 0 V to 20 V/0 A to 5 A range.)
- Impedance measurement
  The measurement AC current can be set for the range at 10 % to 100 % of each range of the rated value in 0.1 % step.
  Impedance measurement under condition of measurement AC voltage at 5 mV applied by the dummy constant voltage can also be set.
- Built-in electronic load offers two constant current modes ranges for the load rating: 5 A and 0.5 A
  Load current setting resolutions of 0.1 mA (5 A range) and 0.01 mA (0.5 A range), with maximum power consumption of 60 W.
- Equipped with “Undervoltage protection”, “Overvoltage protection”, “Overpower protection”, “Overheat protection”, “Overcurrent protection”, and “Line cut detection” as standard.
- The backlit LCD offers enhanced visibility.
- Four types of measurement value can be chosen for display freely from R, X, | Z |, θ , V, and I.
- Equipped with GPIB, RS-232C and USB interfaces as standard.
- Impedance measurements can be made in the range of 10 mHz to 10 kHz as well on both primary and secondary cells.

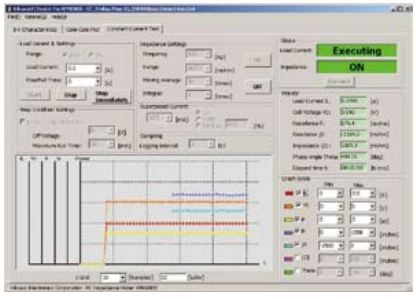
Application software

● The data acquisition of each characteristic test is possible by the application software included as a standard accessory.



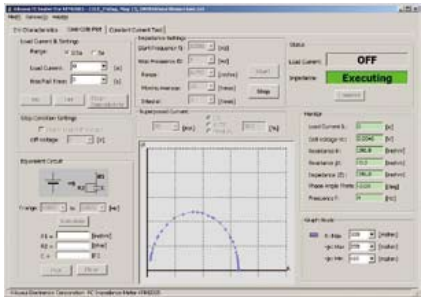
Current-voltage characteristic measurement testing (I-V characteristics)

It measure the voltage of the cell and internal resistance to the load current, and display the Tafel plot. The load current can be increased or decreased with a maximum resolution of 10 µA.



Constant Current characteristic

The logging interval can be adjusted in the range of 1 s to 99999 s with a step of 1 s. At the same time, it is also possible to perform the impedance measurement by the single frequency.



Cole-Cole plot

Based on acquisition of the multipoint plot of the frequency, the value for the circuit constant of the approximate equivalent circuit of the fuel cell can be figured.

KFM2005 Specifications

■ Impedance measurement part

Measurement frequency ..... 10 mHz to 10 kHz
Frequency resolution ..... 14 points/decade - 1.00, 1.26, 1.58,2.00, 2.51, 3.00, 3.16, 4.00, 5.00, 6.00, 6.30, 7.00, 8.00, 9.00
Measurement range *1 ..... 16.5 mA range: 300 mΩ, 1 Ω, 3 Ω/ AUTO,
50 mA range: 100 mΩ, 300 mΩ, 1Ω/ AUTO
Measurement alternated current .. 6 mArms ±10 % (16.5 mA range) ,
18 mArms ±10 % (50 mA range)
Mechanically opens the AC current source
Measurement value display ..... 100 mΩ range: 0.0 mΩ to 999.9 mΩ ,
1,000 Ω to approx. 4,000 Ω
300 mΩ range: 0.0 mΩ to 999.9 mΩ,
1,000 Ω to approx. 12,000 Ω
1 Ω range: 0.0 mΩ to 999.9 mΩ ,
1,000 Ω to approx. 16,000 Ω
3 Ω range: 0.000 Ω to approx. 16,000 Ω
All range: -180.00 deg to 180.00 deg
Measurement display items ..... Four types of measurement value can be chosen for display freely from R, X, | Z | , θ , voltage, and current.
Measurement accuracy *2 *3 ..... 10 mHz to 900 Hz of R, X
±(2 % of | Z | reading +0.5 % of range +1 mΩ /variable ratio)
1 kHz to 4 kHz of R, X
±(3 % of | Z | reading +0.5 % of range +1.5 mΩ /variable ratio)
5 kHz to 10 kHz of R, X
±(4 % of | Z | reading +0.5 % of range +2 mΩ /variable ratio)

■ DC voltage/current measurement part

Voltage range ..... Automatic switch between two ranges: 2 V and 20 V
Voltage measurement resolution ... 2 V range: 100 μV, 20 V range: 1 mV
Voltage measurement accuracy ... 2 V range ±(0.2 % of rdg *4 + 6 digits) ,
20 V range ±(0.7 % of rdg *4 + 8 digits)
Current measurement resolution .. 100 μ A
Current measurement accuracy ... ± 1 % of 5 A (± 50 mA)
Monitor output ..... Voltage monitor: Outputs 10 V
(insulated output for the load) for sensing input voltage of 20 V
Voltage monitor accuracy: ± 0.05 V
Current monitor: Outputs 10 V for load current of 5 A.
Current monitor accuracy: ±0.2 V

■ Electronic load

Operation mode ..... Constant current
Range ..... Two ranges - 0.5 A and 5 A
Maximum load current ..... 5 A
Input voltage range ..... 0 V to 20 V
Maximum input power ..... 60 W
Current setting accuracy ..... 0.5 A range: ±(0.5 % of set *5 + 0.5 mA) ,
5 A range: ±(0.5 % of set *5 + 2.5 mA)
External control *6 ..... 0.5 A range: 0 A to 0.5 A for 0 V to 10 V,
5A range: 0 A to 5 A for 0 V to 10 V

■ Display

240 dots × 64 dots LCD with cold-cathode ray tube backlighting

■ External Control Interface

GPIB, RS-232C,USB

■ Average setting

The integral average (1 to 32) and the moving average (1 to 256) may be used in combination.

■ Protection functions

Overvoltage protection (OVP) ..... The load is cut off if a voltage of 21 V or higher is applied to the sensing terminal.
Overpower protection (OPP) ..... Power of 63 W or higher activates the CP and lights the OVER LOAD LED.
Overheat protection (OHP) ..... The load is cut off if the temperature inside the load unit becomes abnormally high.
Overcurrent protection (OCP) ..... If a load current flows higher than 5.25 A, the LCD displays “ALM:OCP” and the load is cut off.
Undervoltage protection (UVP) ..... The load is cut off if the voltage applied to the sensing terminal falls below the set voltage limit. This voltage limit can be set in the range of –2 V to 20 V.

■ General Specifications

External Control
Input ..... CC control, Load ON/OFF, Load range: 0/5 V
Output ..... V monitor, I monitor, alarms, load status
Environment
Warm-up time ..... 30 minutes or more
Installation altitude ..... 2000 m or below
Storage temperature and humidity range ..... –10 °C to +60 °C, 90 % rh or below (no dew condensation allowed)
Operating temperature and humidity range ..... 0 ℃ to + 40 ℃ , 20 % to 85 % rh or below (no dew condensation allowed)
Guaranteed temperature and humidity range ..... +15 ℃ to + 35 ℃ , 20 % to 85 % rh or below (no dew condensation allowed)
Power
Allowable power voltage range ..... AC90 V to 132 V, AC180 V to 250 V Single phase
Power frequency range ..... 45 Hz to 65 Hz
Maximum power consumption ... 600 VA or less
Dielectric resistance ..... 50 MΩ or more (500 VDC) [between AC line and chassis]
Withstand voltage ..... 1500 VAC/minute [between AC line and chassis]
Dimensions (maximum) ..... 430 (455) W × 88 (105) H × 380 (450) D mm
Weight ..... Approx. 9.5 kg

■ Accessories

Power cord: 1
Load cable: 1
Application software (CD): 1
Sensing cable: 1
Operation manual: 1

■ Options

Rack mount bracket ..... KRB100-TOS (JIS)
KRB2-TOS (EIA)

*1 Values up to four times the range can be measured. If the measurement current varies, the allowable measurement value can be extended in proportion of the varied ratio. It can be varied up to ten times if the measurement current is set to 10 %. The maximum value can be set up to approx. 40 times of the range.
*2 | Z | reading : reading value of "Z"
range: measurement range
variable ratio: variable ratio of measurement current (1 to 0.1)
*3 after 32 times of moving average
*4 rdg: reading value of the input voltage
*5 set: setting value for the input current
*6 The set full scale can be fine-tuned.

Fuel Cell Impedance Meter

KFM2030

GPIB RS-232C USB DRIVERS CE

Dimensions / Weight

430(16.93″)W × 88(3.47″)H × 380(14.96″)Dmm / 9.5kg(20.94 lbs)

Accessories

Operation manual, Power cord, Sensing line, Load line, Application software (CD)

Options

■ Rack mount bracket
KRB100-TOS (JIS standard)
KRB2-TOS (EIA standard)

Application software

- Cole-cole plot
- Current-voltage characteristic measurement testing (I-V characteristics)
- CC mode testing (for aging)

Fuel cell characteristic, variation, and service life testing can be done with ease!

The impedance meter KFM2030 is intended to enable the impedance characteristics of a fuel cell to be measured easily through the use of the AC impedance measurement method.
Using the application software that comes with it, the data acquisition is possible for the I-V characteristic, the Constant Current characteristic, and the Cole-Cole plot by using the AC impedance method. With a low-power DC load (60 W) built in it, KFM2030 supports fuel cell load testing at up to 20 V, at up to 30 A.

Features

- Impedance of cells of up to 20 V can be measured in the range of 10 mHz to 10 kHz. (The cell voltage can be read back as well in the 0 V-20 V range.)
- Two constant current modes ranges for the load rating: 30 A and 5 A Load current setting resolutions of 1 mA (30 A range) and 0.1 mA (5 A range) are available, with maximum power consumption of 60 W.
- Undervoltage protection, overvoltage protection, overpower protection, overheat protection, overcurrent protection, and line cut detection are supported.
- The backlit LCD offers enhanced visibility.
- Four types of measurement value can be chosen for display freely from R, X, | Z |, θ , V, and I.
- Equipped with GPIB, RS-232C and USB interfaces as standard.
- Impedance measurements can be made in the range of 10 mHz to 10 kHz as well on both primary and secondary cells.

KFM2030 Specifications

■ Impedance measurement part

Measurement frequency	10 mHz to 10 kHz
Frequency resolution	14 points/decade - 1.00, 1.26, 1.58, 2.00, 2.51, 3.00, 3.16, 4.00, 5.00, 6.00, 6.30, 7.00, 8.00, 9.00
Measurement range*1	165 mA range (60 mA AC rms): 30 mΩ, 100 mΩ, 300 mΩ, AUTO 500 mA range (180 mA AC rms): 10 mΩ, 30 mΩ, 100 mΩ, AUTO
Measurement alternate current	60 mA rms (165 mA range), 180 mA rms (500 mA range), OFF
Measurement resolution	10 mΩ range: 1 μΩ 30 mΩ, 100 mΩ range: 10 μΩ 300 mΩ range: 100 μΩ
Measurement value display	Four types of measurement value can be chosen for display freely from R, X, | Z | , θ , voltage, and current.
Measurement accuracy	10 mHz to 900 Hz R, X: ±2 % of range*2 1 kHz to 4 kHz R, X: ±3 % of range*2 5 kHz to 10 kHz R, X: ±4 % of range*2

■ DC voltage/current measurement part

Voltage range	Automatic switch between two ranges: 2 V and 20 V
Voltage measurement resolution	2 V range: 100 μV 20 V range: 1 mV
Voltage measurement accuracy	2 V range ±(0.2 % of rdg*3 + 6 digits) 20 V range ±(0.7 % of rdg*3 + 8 digits)
Current measurement resolution	1 mA
Current measurement accuracy	±2 % for 30 A
Monitor output (insulated output for the load)	Voltage monitor: Outputs 10 V for sensing input voltage of 20 V. Voltage monitor accuracy: ±0.05 V Current monitor: Outputs 10 V for load current of 30 A. Current monitor accuracy: ±0.2 V

■ Electronic load

Operation mode	Constant current
Range	Two ranges - 5 A and 30 A
Maximum load current	30 A
Input voltage range	0 V to 20 V
Maximum input power	60 W
Current setting accuracy	±(0.5 % of set*4 +10 mA)
External control*5	5 A range: 0 A to 5 A for 0 V to 10 V 30 A range: 0 A to 30 A for 0 V to 10 V

■ Display

240 dots × 64 dots LCD with cold-cathode ray tube backlighting

Impedance measurement part	10 mΩ → XX.XXX mΩ, 30 mW/100 mΩ → XXX.XX mΩ 300 mΩ → XXX.X mΩ
DC voltage measurement part	0.0000 V to 2.0000 V and 2.000 V to 20.000 V

■ External control interface

GPIB, RS-232C, USB

■ Average setting

The integral average (1 to 32) and the moving average (1 to 256) may be used in combination.

■ Protection functions

Overvoltage protection (OVP)	The load is cut off if a voltage of 21 V or higher is applied to the sensing terminal.
Overpower protection (OPP)	Power of 63 watts or higher activates the CP and lights the OVER LOAD LED.
Overheat protection (OHP)	The load is cut off if the temperature inside the load unit becomes abnormally high.
Overcurrent protection (OCP)	If a load current of 31.5 amperes or higher flows, the LCD displays “ALM:OCP” and the load is cut off.
Undervoltage protection (UVP)	The load is cut off if the voltage applied to the sensing terminal falls below the set voltage limit. This voltage limit can be set in the range of –2 V to 20 V.

■ General specifications

External control	
Input	CC control, LOAD ON/OFF, load range: 0/5 V
Output	V monitor, I monitor, alarms, load status
Environment	
Warm-up time	30 minutes or more
Installation altitude	2000 m or below
Storage temperature and humidity range	–10 °C to +60 °C, 90 % rh or below (no dew condensation allowed)
Operating temperature and humidity range	0 °C to +40 °C, 20 % to 85 % rh or below (no dew condensation allowed)
Guaranteed temperature and humidity range	+15 °C to +35 °C, 20 % to 85 % rh or below (no dew condensation allowed)
Power	
Allowable power voltage range	AC90 V to 132 V, AC180 V to 250 V Single phase
Power frequency range	45 Hz to 65 Hz
Maximum power consumption	600 VA or less
Dielectric resistance	50 MΩ or more (500 VDC) [between AC line and chassis]
Withstand voltage	1500 VAC/minute [between AC line and chassis]
Dimensions (maximum)	430 (455) W × 88 (105) H × 380 (450) D mm
Weight	Approx. 9.5 kg

■ Accessories

Power cord : 1
Load cable: 1
Application software (CD): 1
Sensing cable: 1
Operation manual: 1

■ Options

Rack mount bracket	KRB100-TOS (JIS) KRB2-TOS (EIA)

*1 Values up to four times the range can be measured. Note that, in cases where the drift or ripple of the fuel cell is large or there is much noise, a value lower than the range may be regarded as exceeding the range.
*2 range: Measurement range
*3 rdg: Reading of input voltage
*4 set: Value set for input current
*5 The set full scale can be fine-tuned.

Charge/Discharage System

PFX2511

NEW

Solution to building battery test system by combining with our DC power supply and electronic load.

In these years, voltage (number of stack) and capacity (Ah value) of secondary batteries have become varied, and it is required to support the diversity for characteristic evaluation and the test equipment.
However, general purpose test equipment cannot support measuring and evaluating large capacity batteries.
Therefore, there was no choice but make the special system.
PFX2511 is a high performance Charge/Discharge system controller that enables measuring charge/discharge voltage and current of secondary batteries with high precision by combining our DC power supply and electronic load.
The PFX2511 equips with our technology of Charge/Discharge control and high accurate measurement required for battery characteristic evaluation.
Combination of our DC power supply, electric load and the PFX2511 realizes configuring high precision battery test system with ease.

Dimensions / Weight

214.5(8.45˝)W × 124(4.88˝)H × 400(15.75˝)Dmm / 7kg(15.43 lbs)

Accessories

Operation manual, Power cord, Application Software (Limited version for 2channels only), Cable with crimp terminal(4 pcs./ Red: 2 pcs., White: 2 pcs., 45 cm each (17.72 inch)), 26-core/20-core flat cable, Twisted-pair wire with TP-BUS connectors, TP-BUS core, Sensing connector, Thermistor, Lock lever

Options

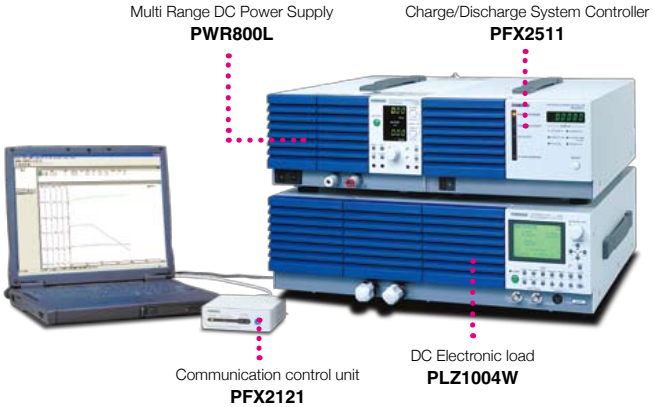
■ Load cable
TL08-PFX .....Cable length: 5 m, Assembled product for PFX2511
■ Voltage/thermometer unit
OP01-PFX .... Logging of voltages and temperatures for 4 cells
TL09-PFX .....K type thermocouple cable, Cable length: 5 m, for 4 cells

Features

- The system for charge and discharge testing can be configured with the selected Kikusui's electronic load and the DC power supply.
- The applicable maximum voltage: 60.0000 V
  The applicable maximum current: 50.0000 A
- The operating mode: Charge mode (CC-CV, CC)
  Discharge mode (CC, CP, CC Pulse, CP pulse)
- Equipped with an electric input/output terminal, load switch (route switch circuit)
- Applied to the temperature measurement
- Equipped with the vibration sensor (auto stop function) .
- The entire operation can be managed by the application software
  The "BPChecker 2000 Basic Edition", a standard accessory, can manage the entire operation from the setting of the test conditions, the execution of the test, and analyzing the test result files. This software can control the thermostatic chambers (manufactured by ESPEC) and also applies to the synchronized test with the thermostatic chambers.

System configuration (example)

The above system configuration consists of the charge/discharge system controller "PFX2511", the DC power supply "PWR800L", and the electronic load "PLZ1004W". The dimention of the system may differ depends on the configuration of the selected models. The PFX2121 (communication control unit) is also required for the control through by the PC. (USB connection)



[Applied configuration (model ID)]

Model ID is used for combination of the selected power supply and electronic load if you wish to have a combination that is not on the available model ID list, please consult with us. More model IDs will be added in future. The latest information for the system configuration is available on our website.

Model ID	Power supply for charge	Electronic load for discharge
5101	PWR800L	PLZ1004W
5102	PWR800L	PLZ1004W *
5103	PWR1600L	PLZ1004W×2
5104	PWR800L	PLZ334W
5106	PWR1600L	PLZ1004W

* M range

Model ID	Power supply for charge	Electronic load for discharge
5107	PAS10-70	PLZ1004W
5108	PAS20-36	PLZ1004W
5109	PAS20-54	PLZ1004W
5110	PAS40-27	PLZ1004W
5111	PWR800L	PLZ164W
5112	PAS10-35	PLZ334W

PFX2511 Specifications

Measurment Accuracy			
Static			
Charge / discharge Current measurement	Range		0.0000 A to 50.0000 A
	Accuracy*1 *2		± (0.15 % of rdng +0.02 % of f.s)
	Resolution		0.1 mA
Voltage measurement	Range		-6.0000 V to 60.0000 V
	Accuracy*1 *2		± (0.05 % of rdng +0.02 % of f.s)
	Resolution		0.1 mV
Capacity calculation	Range		0.0000 Ah to 2000.0000 Ah
	Accuracy*1 *2		Rely on the current measuring accuracy and the time accuracy
	Resolution		0.1 mAh
Time *3	Accuracy*1 *4		±10 ppm (TYP values)
Pulse			
Charge / discharge current	Range		0.0000 A to 50.0000 A
	Accuracy*1 *2		± (0.2 % of rdng +0.03 % of f.s)
	Resolution		0.1 mA
	Measured value		Average current, Update a data per period of 500 ms
Battery voltage	Range		0.0000 V to 60.0000 V
	Accuracy*1 *2		± (0.05 % of rdng +0.02 % of f.s)
	Resolution		0.1 mV
	Measurement point	High voltage	Indicates the maxmum battery voltage in one cycle of the pulse setting.
		Low voltage	Indicates the minimum battery voltage in one cycle of the pulse setting.
		Arbitrary	At the specified pulse point
Capacity calculation	Range		0.0000 Ah to 2000.0000 Ah
	Accuracy*1 *2		Rely on the current measuring accuracy and the time accuracy
	Resolution		0.1 mAh
Time *3	Accuracy*1 *4		±10 ppm (TYP values)
Temperature measurement			
Temperature sensing element			thermistor (103AT-2, Ishizuka denshi)
Measurable range			-40.0 °C to 100.0 °C
Measurement resolution			0.1 °C
Measurement accuracy			±0.5 °C (Measuring temperature at 0 °C to 40.0 °C)
			±1 °C (Measuring temperature at -20 °C to 80 °C)

*1 Ambient temperature at 18 °C to 28 °C.
*2 Measurement range : within the above specified range
*3 Accuracy of the elapsed time (terminate condition) under the discharging state, resting state.
*4 Approx. 30s. of the monthly error

● General Specifications

Input voltage range ..... 90 Vac to 250 Vac
Power consumption..... 60 VAmax, OP01-PFX 3 boards installed: 80 VAmax
Weight ..... Approx. 7 kg (15.43 lb)

[Accessories]
Application Software (BP Checker2000 Basic Editon(CD-ROM)) , Power cord: 1 pc.
Cable with crimp terminal: 4 pcs. (Red: 2 pcs., White: 2 pcs. 45 cm each (17.72 inch)), 26-core flat cable: 1 pc. , 20-core flat cable : 1 pc. , Twisted-pair wire with TP-BUS connectors: 1 pc. (1 m (39.37 inch)) , TP-BUS core: 1 pc., Sensing connector: 1 pc. , Thermistor: 1 pc. , Lock lever: 2 pc. , Operation manual: 1 copy, BPChecker 2000 setup guide: 1 copy

* Load cable (TL08-PFX) is not included. It is sold separately.
* For rack mounting, the rack adapter KRA3 (inch) or KRA150 (millimeter) is required.

Voltage/thermometer unit OP01-PFX

Cell Voltage measurement		
Static		
Number of measurement terminals		4
Measurable range*1		-2.0000 V to 20.0000 V
Accuracy		±(0.05 % of rdng +0.02 % of f.s)
Measurement resolution*2		0.1 mV
Measurement value		Average voltage of the every 500 ms
Measurement interval		500 ms
Pulse		
Number of measurement terminals		4
Measurable range*1		-2.0000 V to 20.0000 V
Accuracy		±(0.05 % of rdng +0.02 % of f.s)
Measurement resolution*2		0.1 mV
Measurement value*3	High voltage	Maximum voltage in one cycle
	Low voltage	Minimum voltage in one cycle
	user-specified	–
Measurement interval*4		1 ms

*1 You can apply a voltage from -20 V to 22 V.
*2 Ambient temperature at 18 °C to 28 °C
*3 Automatically synchronized with the PFX2511 pluse setting (specify two points from high voltage, low voltage, and user-specified).
*4 The application software records data every second.

Cell Temperature measurement *1	
Number of measurement terminals	4
Thermocouple type	K type
Measurable range*2	-100.0 °C to 400.0 °C
Accuracy*3*4	±1.5 °C (TYP values)
Reference junction compensation*3*5	±0.5 °C(TYP values)
Resolution	0.1 °C

*1 The temperature scale conforms to JIS C 1602-1995(ITS-90).(ITS-90 is an international temperature scale.)
*2 Depending on your thermocouple's specifications(wire diameter and insulation), the usable temperature range will vary.
*3 Ambient temperature at 18 °C to 28°C.
*4 When the voltage that the thermocouple's calibrator produces is measured(the thermocouple tolerance is not included)
*5 This shows the internal sensor performance.
It indicates the temperature measurement accuracy of the thermocouple connector.
Thermometer accuracy= Measurement accuracy + reference junction compensation + thermocouple tolerance

Battery Test System

PFX2000 Series

This photo shows a 5-unit frame (PFX2332) housing 5 charging/discharging power supply units (3 PFX2011 units and 2 PFX2021 units) combined with an impedance measurement unit (PFX2211).

Dimensions / Weight

PFX2332: 442(17.4″)W × 177(6.97″)H × 550(21.65″)Dmm / 13kg(28.66 lbs)
PFX2121: 107(4.21″)W × 34(1.34″)H × 130(5.12″)Dmm / 500g(1.1 lbs)
PFX2211: 430(16.93″)W × 44(1.73″)H × 270(10.63″)Dmm / 4kg(8.82 lbs)

Model name	Product name
PFX2011	Charging/discharging power supply unit (2 channels)
PFX2021	Charging/discharging power supply unit (1 channel)
PFX2332	5-unit frame
PFX2121	Control unit (max. 120 channels)
PFX2211	Impedance measurement unit
SD002	Application software BPChecker

Options

■ Impedance measurement cabl
TL02-PFX(1M) ·····Cable length: 1 m
TL02-PFX(3M)·····Cable length: 3 m
TL02-PFX(5M)·····Cable length: 5 m

■ Load cable (7 m)
TL04-PFX ·····Kit product for PFX2011
TL06-PFX ·····Assembled product for PFX2011
TL05-PFX ·····Kit product for PFX2021
TL07-PFX ·····Assembled product for PFX2021

Implementing sophisticated battery tests with ease…

A highly flexible system can be built

The PFX2000 Series is a battery test system developed on the basis of the experience and know-how that we have amassed through implementing numerous custom-built battery evaluation systems. The product adopts a unit structure that houses charging/discharging power supply units (PFX2011 or PFX2021) inside a unit frame (PFX2332). This enables you to build your battery test system in varying scale, from a small-size system with a single cell to a large-size system consisting of up to 120 units (max. 240 channels when all the units are PFX2011), making it possible to support any number of channels necessary for the test. Also, PFX2000 offers high availability by allowing you to replace only the unit that needs maintenance and to continue the test without stopping the entire system (hot plug feature). Each channel is completely independent of one another and thus can be controlled under different test and timing conditions. In addition, a rich set of protection features (OVP, UVP, OHP, etc.) is supported to prevent the test material from being destroyed by a system malfunction or operation mistake.

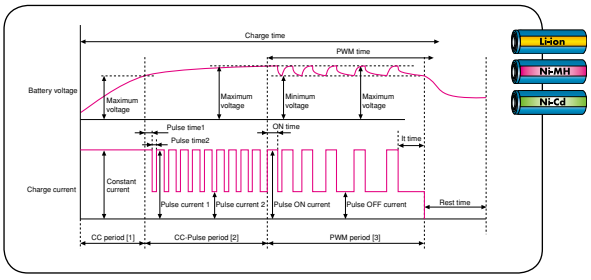
[Notes]
PFX2021 cannot be operated with the previous 5-unit frame model (PFX2331).

Features

■ CC pulse discharging mode intended for load patterns of cellular phones and other devices
■ CP pulse discharging mode intended for load patterns of digital cameras and notebook PCs (PFX2021)
■ Temperature measurement function
■ Synchronized operation with thermostatic chamber
■ Equipped with a V/F converter that ensures more accurate current measurement at pulse discharge (PFX2021).
■ Power regeneration function (PFX2021)
■ Expandable on a unit-by-unit basis.
■ Allows PFX2011 and PFX2021 to coexist in a single frame.

Example of Charging Mode

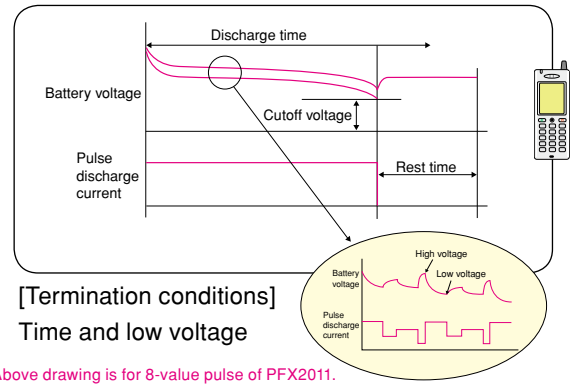
CC PWM (Constant current PWM pulse)



[Termination conditions]
Time and off time

Example of Discharging Mode

CC Pulse (Constant current 8-value/20-value pulse)*



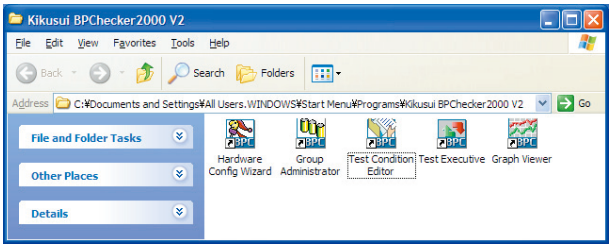
[Termination conditions]
Time and low voltage

*Above drawing is for 8-value pulse of PFX2011.
20-value pulse is applied for PFX2021.

Application Software BPChecker2000

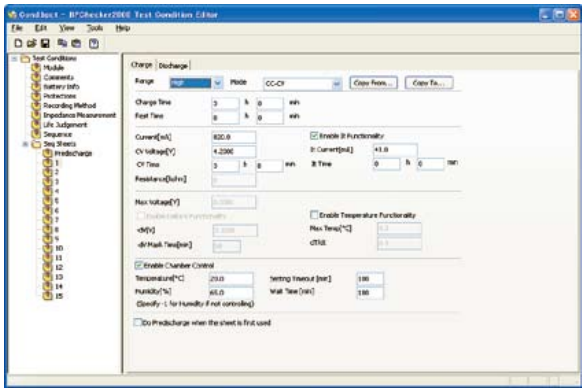
BPChecker2000 is an application software for the PFX2000 Series Charge/Discharge Battery System. BPChecker2000 enables you to set the conditions of the battery charge/discharge characteristics tests, execute the tests, and analyze the test results on a Personal Computer (PC). This application software allows you to control two systems of PFX2121 120-ch Control Units via the USB port. This means that up to 240 charge/discharge power supply channels can be controlled simultaneously.
Furthermore, by adding a PFX2211 Impedance Measurement Unit, impedance can be measured up to 120 charge/discharge power supply channels that are connected to the control unit of the same system. Moreover, if the PC is capable of GPIB communications, thermostatic chamber (by Espec Corp.) can be controlled externally for synchronized testing.

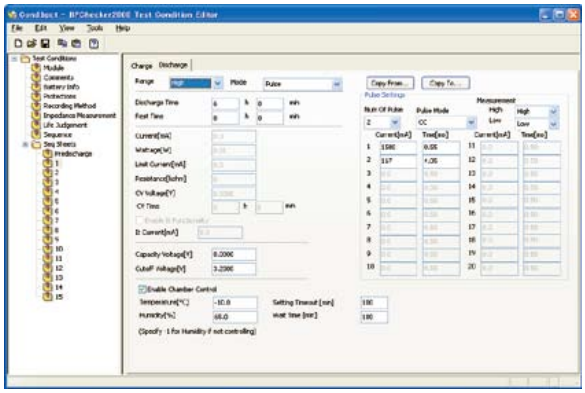
● BPChecker2000 consists of the following five components.



[Test Condition Editor]

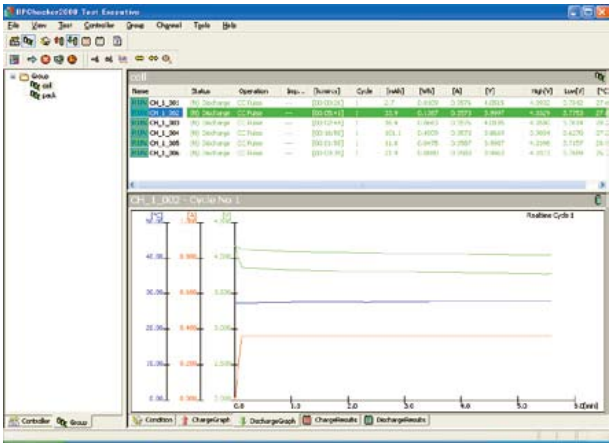
A total of 15 sheets of test condition data can be set, with each sheet specifying both the charging and discharging conditions. It is also possible to set the number of times (repeats) that an individual sheet is to be repeated to form a particular charging/discharging cycle, as well as the number of times (loops) that the entire set of sheets is to be repeated.





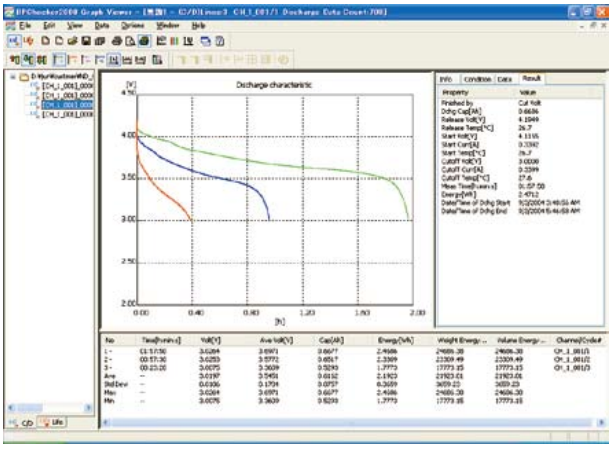
[Test Executive]

This application controls the execution of the test. It starts and stops the test and monitors the test execution. It provides a real-time graphical representation of the per-channel charging/discharging trends.



[Graph Viewer]

This application offers graphical representations of the charging/discharging data for each cycle. It can display up to 99 sets of data overlaid one another in a single graph and perform statistical processing.



[Hardware Configuration Wizard]

This is a program to detect the charge/discharge power supply units that are connected to the control unit and configure the connection environment with other hardware devices (Impedance measurement unit, Thermostatic chamber, etc.).

[Group Administrator]

This is a program to create, delete Group for performing tests.

Operating Environment for BPChecker2000

Windows2000 (SP4 + Update Rollup 1), WindowsXP (SP2 or later, ×86), WindowsVista (×86/×64), Windows7 (×86/×64), USB port, and GPIB board that supports VISA library when thermostatic chamber control will be exerted.

PFX2000 Series Specifications

Item		PFX2011	PFX2021
Rated output			
Number of output channels		2	1
Charging current range		0.0 mA to 5000.0 mA (high range), 0.00 mA to 500.00 mA (low range)	0 mA to 10000 mA
Charging voltage range		0.0000V to 5.0000V	0.000 to 20.000 V
Discharging current range		0.0 mA to 5000.0 mA (high range), 0.00 mA to 500.00 mA (low range)	0 mA to 10000 mA
Discharging voltage range		–0.5000 V to 5.0000 V	–2.000 V to 20.000 V
Maximum charging/discharging power		25 W	200 W
Setting accuracy			
Constant current charging/discharging	Range	0.0 mA to 5000.0 mA (high range), 0.00 mA to 500.00 mA (low range)	0 mA to 10000 mA
	Accuracy*1	±(0.05 % + 1.0 mA) (high range), ±(0.05 % + 0.1 mA) (low range)	±(0.15 % + 2.0 mA)
	Resolution	0.1 mA (high range), 0.01 mA (low range)	1 mA
	Ripple*2	1 mArms (high/low range)	3 mArms
Constant voltage charging	Range	0.0000 V to 5.0000 V	0.000 V to 20.000 V
	Accuracy*3	±(0.03 % + 1 mV)	±(0.10 % + 3.0 mV)
	Resolution	0.1 mV	1 mV
	Ripple*2	2 mVrms	5 mVrms
Constant power discharging	Range	0.01 W to 25.00 W (high range), 0.001 W to 2.500 W (low range)	0.02 W to 200.00 W
	Accuracy*4	±(0.1 % + 10 mW) (high range), ±(0.1 % + 2 mW) (low range)	±(0.50 % + 20.0 mW)
	Resolution*5	10 mW (high range), 1 mW (low range)	10 mW
Pulse constant current discharging	Range	0.0 mA to 5000.0 mA (high range), 0.00 mA to 500.00 mA (low range)	0 mA to 10000 mA
	Resolution	0.1 mA (high range), 0.01 mA (low range)	1 mA
	Accuracy*1	±(0.07 % + 1 mA) (high range), ±(0.07 % + 0.1 mA) (low range)	±(0.15 % + 3 mA)
	Number of settings	8 values	20 values
	Response*6	50 µs (TYP)	70 µs (TYP)
Pulse constant power discharging	Range	–	0.02 W to 200.00 W
	Resolution	–	10 mW
	Accuracy	–	±(0.5 %+20.0 mW)
	Number of settings	–	20 values
	Update rate	–	2 ms (typical)
Pulse time width	Range*7	0.50 ms to 65000.00 msec	
	Resolution	10 µs	
	Accuracy	±(0.05 % + 0.05 ms)	
Measurement accuracy			
Current measurement	Range	0.0 mA to 5000.0 mA (high range), 0.00 mA to 500.00 mA (low range)	0.0 mA to 10000.0 mA
	Accuracy*8	±(0.04 % + 0.8 mA) (high range), ±(0.04 % + 0.08 mA) (low range)	±(0.15 % + 1.5 mA)
	Resolution	0.1 mA (high range), 0.01 mA (low range)	0.1 mA
Voltage measurement	Range	–0.5000 V to 5.0000 V	–2.0000 V to 20.0000 V
	Accuracy*8	±(0.02 % + 1 mV)	±(0.10 % + 2.0 mV)
	Resolution	0.1 mV	
Pulse charging/ discharging current	Measurement value*9	Average current	
	Range	0.0 mA to 5000.0 mA (high range), 0.00 mA to 500.00 mA (low range)	0.0 mA to 10000.0 mA
	Accuracy	±(0.1 % + 1 mA) (high range), ±(0.1 % + 0.1 mA) (low range)	±(0.20 % + 3.0 mA)
	Resolution	0.1 mA (high range), 0.01 mA (low range)	0.1 mA
Pulse battery voltage	Measurement point	High/low, any given point	
	Range	–0.5000 V to 5.0000 V	–2.0000 V to 20.0000 V
	Accuracy	±(0.05 % + 1 mV)	±(0.15 % + 2 mV)
General specifications			
Power consumption*10	At rated output	400 VA Max	800 VA Max
	With no load	60 VA Max	50 VA Max

*1 Measured within the rated range with respect to the set current.
*2 Maximum value at 10 Hz to 500 kHz
*3 Measured within the rated range with respect to the set voltage.
*4 Measured with respect to the set power when the battery voltage is not less than 0.5 V (PFX2011) or 2 V (PFX2021).
*5 Voltage operation range (guaranteed value) for constant power discharging - 0.5 to 5 V (PFX2011) or 2 - 20 V (PFX2021)
*6 At 10 % to 90 % of the pulse current waveform when the rated current is set; shorted at the end of the 7-meter load cable.
*7 The pulse time width is measured by the mesial magnitude of the pulse.
*8 Measured within the rated range with respect to the measured value.
*9 Average current measured at intervals of 500 ms
*10 Power consumption per unit

TOS SERIES SELECTION GUIDE

The Electrical Appliance & Material Safety Low (Japan), UL (U.S.A.), CSA (Canada), VDE (Germany) and BS (U.K) are some major examples of safety standards in use throughout the world that require the performing of hipot testing. For this reason, it is necessary to confirm for what portion of what standard testing is to be performed when purchasing a hipot tester. Although the 500 VA capacity hipot testers available from KIKUSUI can basically be applied to tests specified in all safety standards, we recommend that you consult with us prior to purchase in order to select the model that best matches your specific application.

Hipot Tester with Insulation Resistance Test

Hipot Tester

High-End

High-performance type suitable for R&D, Quality Assurance, and Automatic Testing Systems

TOS9201 P.72 to 74

ACW 5kV/100mA(500VA)
DCW 6kV/10mA
IR 0.01MΩ – 9.99GΩ (DC25V – 1000V)

Rise Time Fall Time GPIB RS-232C Timer

D 430(16.93˝)W × 132(5.2˝)H × 370(14.57˝)Dmm
W 19kg(41.89 lbs)

TOS9200 P.72 to 74

ACW 5kV/100mA(500VA)
IR 0.01MΩ – 9.99GΩ (DC25V – 1000V)

Rise Time Fall Time GPIB RS-232C Timer

D 430(16.93˝)W × 132(5.2˝)H × 370(14.57˝)Dmm
W 19kg(41.89 lbs)

TOS9213S P.75 NEW

DCW 10kV/5mA
IR 0.01MΩ – 9.99GΩ (DC25V – 1000V)

Rise Time GPIB RS-232C Timer

D 430(16.93˝)W × 132(5.2˝)H × 400(15.75˝)Dmm
W 13kg(41.89 lbs)

TOS9220/9221 P.76

High-voltage scanner (4ch) for TOS9201/9200
* TOS9221 is equipped with a contact check function

D 430(16.93˝)W × 88(3.47˝)H × 370(14.57˝)Dmm
W 6.5kg(14.33 lbs)

Standard

Standard type suitable for production and inspection lines

TOS5302 P.84 to 85 NEW

ACW 5 kV/100 mA(500 VA)
IR 0.03 MΩ – 5 GΩ (DC25 V – 1000 V)

Rise Time Fall Time USB Timer

D 320(12.60˝)W × 132(5.2˝)H × 350(13.78˝)Dmm
W 14 kg(30.9 lbs)

TOS5301 P.84 to 85 NEW

ACW 5 kV/100 mA(500 VA)
DCW 6 kV/10 mA(50 W)

Rise Time Fall Time USB Timer

D 320(12.60˝)W × 132(5.2˝)H × 350(13.78˝)Dmm
W 15 kg(33.1 lbs)

TOS5300 P.84 to 85 NEW

ACW 5 kV/100 mA(500 VA)

Rise Time Fall Time USB Timer

D 320(12.60˝)W × 132(5.2˝)H × 350(13.78˝)Dmm
W 14 kg(30.9 lbs)

TOS5101 P.82

ACW 10kV/50mA(500VA)
DCW 10kV/5mA

Timer

D 430(16.93˝)W × 177(6.97˝)H × 370(14.57˝)Dmm
W 24kg(52.91 lbs)

TOS5051A P.89

ACW 5kV/100mA(500VA)
DCW 5kV/10mA

RS-232C Timer

D 320(12.6˝)W × 132(5.2˝)H × 300(11.81˝)Dmm
W 19kg(41.89 lbs)

TOS5050A P.89

ACW 5kV/100mA(500VA)

RS-232C Timer

D 320(12.6˝)W × 132(5.2˝)H × 300(11.81˝)Dmm
W 18kg(39.68 lbs)

ACW Max. output-voltage of AC hipot testing
DCW Max. output-voltage of DC hipot testing
IR Measurement range of insulation resistance testing
D Dimensions
W Weight

Rise Time Equipped with rise time control function
Fall Time Equipped with fall time control function
GPIB Equipped with GPIB interface as standard
RS-232C Equipped with RS-232C interface as standard

USB Equipped with USB interface as standard
Timer Equipped with timer function

Insulation Resistance Tester

TOS7200 P.91

IR 0.01MΩ – 5000MΩ (DC25V – 1000V)

RS-232C Timer

D 215(8.47˝)W × 66(2.6˝)H × 230(9.06˝)Dmm
W 2kg(4.41 lbs)

Ground Bond Tester

TOS6210 P.94

0.001Ω – 0.600Ω (6A – 62A)

GPIB RS-232C Timer

D 430(16.93˝)W × 88(3.47˝)H × 270(10.63˝)Dmm
W 11kg(24.25 lbs)

TOS6200 P.94

0.001Ω – 1.200Ω (3A – 30A)

GPIB RS-232C Timer

D 430(16.93˝)W × 88(3.47˝)H × 270(10.63˝)Dmm
W 9kg(19.84 lbs)

Leakage Current Tester

TOS3200 P.98

30μA – 30mA (RMS)

USB GPIB RS-232C Timer

D 320(12.6˝)W × 88(3.47˝)H × 270(10.63˝)Dmm
W 5kg(11.02 lbs)

Options

- Remote Control Box
- Test Probe
- Test Lead
- Warning Light Unit
- Buzzer Unit
- Load resistor for calibration of a Hipot Tester

P.100,101

- Data Acquisition Software (for TOS5051A/5050A)

P.101

The Electrical Appliance & Material Safety Low (Japan), UL (U.S.A.), CSA (Canada), VDE (Germany) and BS (U.K) are some major examples of safety standards in use throughout the world that require the performing of hipot testing. For this reason, it is necessary to confirm for what portion of what standard testing is to be performed when purchasing a hipot tester. Although the 500 VA capacity hipot testers available from KIKUSUI can basically be applied to tests specified in all safety standards, we recommend that you consult with us prior to purchase in order to select the model that best matches your specific application.

For the withstanding test and the insulation resistance test of the EUT (Equipment Under Test) with turned on electricity.

Our Hipot Testers and Insulation Resistance Testers are designed to test the EUT (Equipment Under Test) with turned off electricity. In case the test requires the EUT (Equipment Under Test) with turned on electricity, please contact with our distributor or agent.

Hipot Tester with Insulation Resistance Test

TOS9200/9201

GPIB RS-232C DRIVERS CE

TOS9200(AC)

TOS9201(AC/DC)

Perfect design for System Operation, introducing our top of the line of Hipot / Insulation Resistance Testers

The TOS9200 Series has been developed to meet a wide diversity of customer needs. Including the refinement and enforcement of Kikusui's former series, its specifications reflect the results of detailed study of our large database of user's requirements including special orders and modifying specifications.

The TOS9200 Series consists of four products : the testers TOS9200 and TOS9201, and the high-voltage scanners TOS9221 and TOS9220. The TOS9200 is equipped with AC hipot and insulation resistance testing functions, while the TOS9201 has a DC hipot testing function in addition to these two functions. The power block, a core component, employs a high-efficiency switching power supply and a switching amplifier based on PWM systems. These features realize high power and enhanced stability, as well as reducing the size and weight of the unit. When combined with the ground bond tester TOS6200, the TOS9200 Series integrates three or four types of tests in a single process.

Furthermore, when used together with the high-voltage scanner TOS9220/9221 (equipped with a contact check function), the tester is capable of automatically checking test points for up to 16 channels, thereby facilitating a safe, reliable automatic testing system.

Dimensions / Weight

TOS9201/9200 :430(16.93″)W × 132(5.2″)H × 370(14.57″)Dmm / 19kg(41.89 lbs)

Accessories

AC Power cable, High-voltage test lead wire TL01-TOS (1.5 m), Interlock jumper, High-Voltage Danger seal, Fuse, Operation Manual(Operation Manual for Tester, Operation for GPIB/RS-232C Interface)

Features

- Rise-time control function
- Fall-time control function
- Offset cancel function
- Measured-value hold function
- Output voltage monitoring function
- Memory function
- Program function
- Interlock function
- DC discharge function

Basic performance

■ Three functions - AC hipot testing, DC hipot testing and insulation resistance testing

The TOS9200 can perform AC hipot tests and insulation resistance tests, while the TOS9201 can also conduct DC withstanding tests. Once connected to a device being tested, the TOS9201 executes an AC hipot test, DC hipot test, and insulation resistance testing in succession in one process.

■ AC hipot testing at 5 kV and 100 mA

Equipped with a high-efficiency switching power supply in its high-voltage power block, a PWM-based switching amplifier and a 500 VA high-voltage transformer, the TOS9200/TOS9201 realizes a maximum output of 5 kV/100 mA (continuous output for 30 minutes), or 2.5 times the output of Kikusui's former models. At a test voltage of 500 V or more and an upper current of 100 mA, or greater the tester instantaneously satisfies the requirements of a short-circuit current of 200 mA or more which is required by the IEC standard*. In addition, the tester ensures a load effects of 30% or less and the generation of a consistent 50 Hz/60 Hz test voltage free from the affect of the supply voltage. These features eliminate the need to readjust the output voltage once the test voltage is preset.

*Continuous outputs are impossible because the output is cut off if an overcurrent is detected.

■ DC hipot testing at 6 kV and a maximum output of 50 W

The TOS9201 permits DC hipot testing at up to 6 kV*. The tester is equipped with a stable, low-ripple DC/DC converter with a load factor of 1 % or less.

*Maximum output of 50 W for up to 1 minute.

■ Insulation resistance testing at 25 V to 1000 V and 0.01 MΩ to 9.99 GΩ

The test voltage can be set to 25 V through 1000 V at a resolution of 1 V. Insulation resistance covers a wide measurement range from 0.01 MΩ to 9.99 GΩ*.

A single unit of the TOS9200/9201 is capable of handling all test voltages required by JIS C 1302 1994 (Insulation Resistor Meter) and fully meets the JIS requirements.

*At a maximum rated current of 1 mA to 50 nA.

Test voltage	Resistance measurement range
25 V	0.03 MΩ to 500 MΩ
50 V	0.05 MΩ to 1.00 GΩ
100 V	0.10 MΩ to 2.00 GΩ
125 V	0.13 MΩ to 2.50 GΩ
250 V	0.25 MΩ to 5.00 GΩ
500 V	0.50 MΩ to 9.99 GΩ
1000 V	1.00 MΩ to 9.99 GΩ

■ Enhanced measurement accuracy

The TOS9200/9201 is provided with a digital voltmeter for hipot testing at an accuracy of ±(1 % of reading + 30 V) and another one for insulation resistance testing at an accuracy of ±(1 % of reading + 1 V). Measured values are displayed not only during a test, but while a program is being executed. A digital ammeter with an accuracy of ±(3 % of reading + 20 μA) is also provided for hipot testing. Kikusui's predecessors had the highest measurement resolution of about 1 mA , with an accuracy of ±5 % of the upper cutoff current when it is set to 100 mA. In contrast, the digital ammeter allows the TOS9200/9201 to make measurements at an accuracy of ±(3 % of reading + 20 μA), even if the upper current is set to 100 mA. The ammeter displays measured values while the program executes, as well as during an AC or DC hipot test.

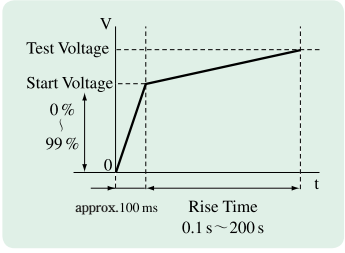
Type	Display accuracy
Voltmeter for hipot testing	± (1 % of reading + 30 V)
Ammeter for hipot testing	± (3 % of reading + 20 μA)
Voltmeter for insulation resistance testing	± (1 % of reading + 1 V)
Insulation resistance meter	± (2 % of reading)*

*At 1 μA< measured current ≤ 1 mA

Diverse functions

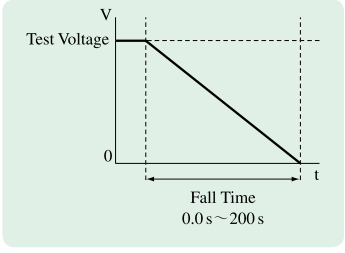
■ Rise-time control function

In AC hipot testing, DC hipot testing and insulation resistance testing, you can apply a voltage gradually to reach the test voltage, instead of applying the test voltage directly at the start of a test. The voltage increase time can be set to 0.1 s through 99.9 s at a resolution of 0.1 s, and to 100 s to 200 s at a resolution of 1 s. The start voltage is also adjustable between 0% and 99 % at a resolution of 1 %.



■ Fall-time control function

In AC hipot testing, you can gradually decrease the test voltage after a PASS judgment. The voltage fall time is adjustable between 0.0 s and 99.9 s at a resolution of 0.1 s, and between 100 s and 200 s at a resolution of 1 s.



■ Offset cancel function

In AC hipot tests that require high sensitivity and high voltages, currents flowing into the stray capacity of the test lead wire, jigs, and other components can cause measurement errors. The TOS9200/9201 features a function to cancel these offset currents.

■ Voltage hold function

During measurement, this function allows you to hold the value of the voltage measured at the end of an AC or DC hipot test, as long as the test results are being displayed. When combined with the rise-time control function, this function enables to observe the insulation breakdown voltage.

■ Maximum Leakage current and minimum resistance hold function

By selecting "MIN/MAX Mode" in the measurement mode settings, you can hold the maximum current in hipot testing and the minimum resistance after the judgment wait time in insulation resistance testing. These values are shown on the tester's display. They can also be read back via interface (GPIB or RS-232C).

■ Output voltage monitoring function

When the output voltage deviates from ±(10% of setting + 50 V), the monitoring function activates to suspend the test, thus ensuring highly reliable testing.

■ Current detection response speed adjustment function

This function switches current detection response speeds for UPPER judgment by adjusting the integrated time constant of the current detection circuit. Three modes are available for the integrated time constant: SLOW (about 40 ms), MID (about 4 ms) and FAST (about 0.4 ms). SLOW mode is used in normal operations. MID and FAST modes are more effective in detecting a discharge occurring instantaneously or containing a large number of frequency components. They are also useful for hipot tests of test devices that insulation likely be breakdown, such as small electronic components.

■ Memory function

Up to 100 test conditions used in AC and DC hipot testing and insulation resistance testing, such as the test voltage, judgment value and test time, can be stored with a specific name. For instance, you can store the name of an applied safety standard and the destination of the product to be tested. If test conditions are preset, operator can recall relevant test conditions simply by entering the memory number. If you previously assigned a special name to each of these test conditions, operator can check recalled test conditions by name. The memory function allows you to recall test conditions not only through the recall operation on the front panel, but also by remote control.

[Storable test conditions]

	AC Hipot testing	DC Hipot testing	Insulation resistance testing
Test voltage	✔	✔	✔
Test frequency	✔		
Lower cutoff value	✔	✔	✔
ON/OFF of the lower judgment function	✔	✔	✔
Upper cutoff value	✔	✔	✔
ON/OFF of the upper judgment function			✔
ON/OFF of the offset function	✔		
Test time and ON/OFF of the timer function	✔	✔	✔
Start voltage	✔	✔	
Voltage rise time	✔	✔	✔
Voltage fall time	✔		
Judgment wait time		✔	✔
Test voltage range	✔		
SLOW/MID/FAST settings for the response filter	✔		
FLOAT/GND of the LOW terminal	✔	✔	✔
HIGH/LOW/OPEN settings for the scanner channel	✔	✔	✔
ON/OFF of the contact check function	✔	✔	✔

■ Program function

By coordinating test conditions stored in an AC hipot test, DC hipot test, and insulation resistance test, operator can sequentially run tests that comprise up to 100 steps. When used together with the ground bond tester TOS6200, the TOS9200 Series permits continuous tests combining test conditions stored in the TOS6200, as well as on the TOS9200 itself. Sequential tests are possible, for example, on AC hipot, insulation resistance, DC hipot, and ground bond , in order. The TOS9200 Series stores up to 500 steps and 100 programs, which can be recalled through the recall operation on the front panel or by remote control.

[Sample program]

Step 00		Step 01		Step 02		
Memory	Interval	Memory	Interval	Memory	Interval	END
ACW01	0.2s	DCW01	0.2s	IR01	0.2s	

At Step 00, Step 01 and Step 02, memory ACW01 (AC hipot test), DCW (DC hipot test: TOS9201 only) and IR01 (insulation resistance test) are performed, receptively, in succession at 0.2-second intervals.

Hipot Tester with Insulation Resistance Test

TOS9213S

GPIB RS-232C CE

NEW

Dimensions / Weight

430(16.93″)W × 132(5.2″)H × 370(14.57″)Dmm / 13kg(28.7 lbs)

Accessories

AC Power cable, High-voltage test leadwire:TL01-TOS (1.5m), 14-pin Amphenol plug(assembly type), “DANGER HIGH VOLTAGE” sticker, AC power fuse (One in present use and the other as spare in the fuse holder cap), Operation manual

Suitable for the insulation testing of PV module

The TOS9213S, DC Withstanding Voltage/Insulation Resistance Tester, is the test instrument that can handle the insulation test with high voltage and high resolution required for the evaluation of the PV module, Cable, Connector, and Junction Box. The TOS9213S is equipped with functions of the DC withstanding voltage testing and the insulation resistance testing accompanied with the features and performance of Kikusui’s high-end model TOS9200 series, and it extends additional features and specifications exclusively applied to the PV module testing.

Features

- Up to 10 kV/5 mA with a maximum output of 50 W in DC withstanding voltage test
- Perform insulation resistance testing in the range of -25 V to -1000 V / 0.01 M to 9.99 G
- Applies for the testing of IEC61730-2 standard
- High-precision current measurement, 1 µA of the setting resolution for judgement
- High-precision current measurement, 1 µA of the setting
- Low output ripple of 100V p-p at 10 kV with consideration of capacitive load
- Rise-time control function makes a voltage to be increased slowly and it will not give effect of the stress to the PV module
- Rise-time control function makes a voltage to be increased

TEST IMAGE

Test example: Insulation Resistance test on Crystalline silicon PV module

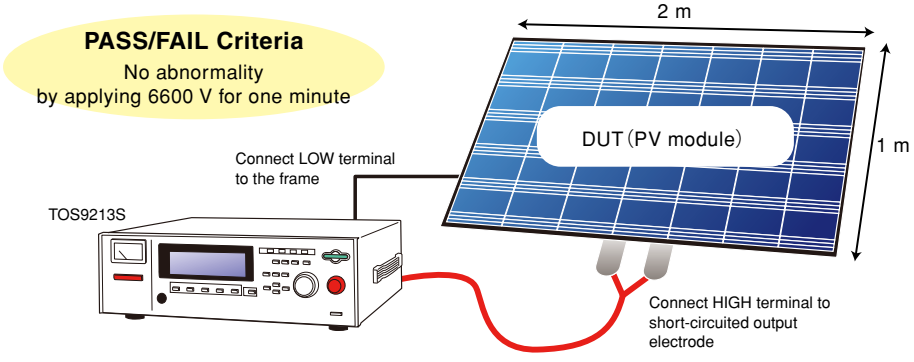
Performs Hipot (Withstanding voltage) test by applying DC high voltage between electrode of PV module and the frame.

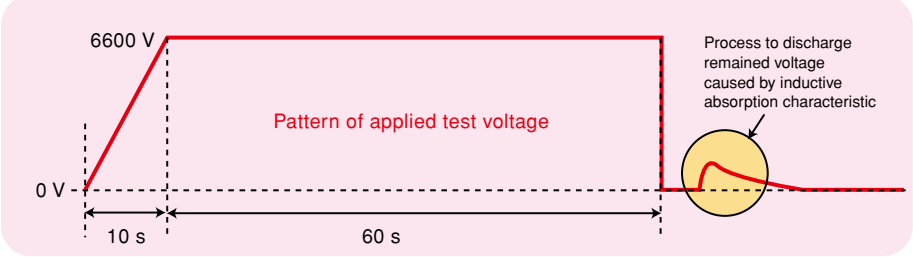
Test voltage: 6600 V (1000 x 4 + 2000) + 600 V (optional margin voltage)

System voltage × 4 + 2000 V

PASS/FAIL Criteria

No abnormality
by applying 6600 V for one minute





Above figures are example images of the test. The test conditions shall depend on the standards to comply and the DUT specification. Please check the latest standards and the DUT specification to conduct the actual test.

High-voltage scanner

TOS9220/9221

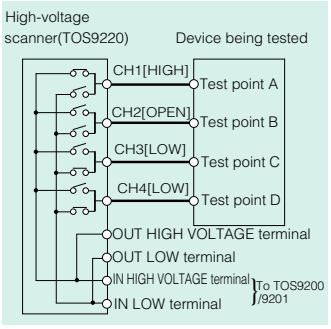
CE

TOS9220 (same for TOS9221)

Functions

■ Operation of the high-voltage scanner

On the TOS9200/TOS9201, you can select an electric potential mode for each channel – HIGH (high voltage side), LOW (low voltage side), and OPEN (open mode).The high-voltage scanner permits AC/DC hipot or insulation resistance tests on any of the four test points A to D. For instance, you can set CH1 (test point A) to HIGH, CH2 (test point B) to OPEN, and CH3 (test point C) CH4 (test point D) to LOW. To specify these settings, you can use the TOS9200/9201 panel or the GPIB/RS-232C.



Extended features of TOS9200/9201 for multi-channel Testing Application

The high-voltage scanner TOS9220/TOS9221 has a function that distributes the test voltage provided by the TOS9200/9201 to multiple test points. Up to four channels can be used for outputs on this scanner. Each channel can be set to one of the three electric potential modes – HIGH, LOW, or OPEN. Operator can conduct AC/DC hipot and insulation resistance tests on any of the four test points. Furthermore, up to four scanners can be connected to the tester, allowing a maximum of 16 channels. The TOS9221 is equipped with a "contact check function" to check the contact between the output of each channel and a test point.

These features ensure highly reliable and labor-saving hipot and insulation resistance tests for electrical and electronic equipment with multiple test points.

Dimensions / Weight

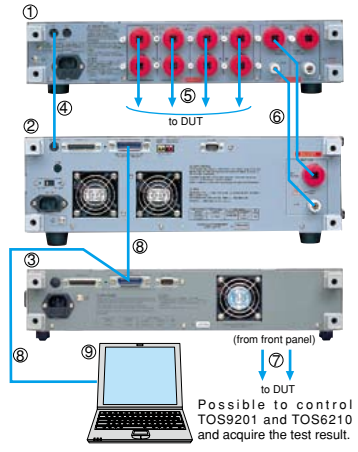
TOS9220/9221 :430(16.93″)W × 88(3.47″)H × 370(14.57″)Dmm / 6.5kg(14.33 lbs)

Accessories

AC power cable, High-voltage test leadwires, red (1.5 m each), High-voltage leads for parallel connection(0.5 m each), Interface cable(0.5 m), Channel-indication stickers(For the panel face, for the test leadwires), "HIGH VOLTAGE, DANGER" stickers, Fuses, Operation Manual

Fully Automated System by PC···

Example of system consisting TOS9201, TOS9221 (4CH) and TOS6210



Item	Model	cable length	Reguired numbers
① High-Voltage Scanner	TOS9221		1 pc.
② Hipot / Insulation Resistance Tester AC/DC	TOS9201		1 pc.
③ Ground Bond Tester	TOS6210		1 pc.
④ Interface cable	85-50-0210	0.5 m *1	1 pc.
⑤ High-Voltage Test Lead (red)	TL07-TOS	1.5 m	4 pc.
⑥ High-Voltage Leads for Parallel connection	TL06-TOS	0.5 m *2	1 set
⑦ Low-Voltage Test Lead	TL12-TOS	1.5 m	1 set
⑧ GPIB Cable	408J-102	2 m *3	2 pc.
⑨ PC (with GPIB Interface cable)			1 pc.

*1: If the length of cable is required more than 0.5 m , please contact with our local distributor.
*2: Also available for 1.5 m(59.06 lbs) cable, TL04-TOS
*3: Also available for 1 m(39.37 lbs) cable, 408J-101 and 4 m cable, 408J-104

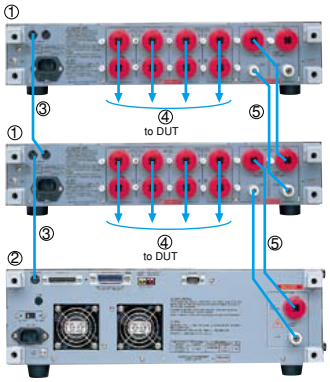
[Rack mount bracket]

TOS9200 / 9201	(JIS)	KRB150-TOS	(EIA)	KRB3-TOS
TOS9220 / 9221 / 6210 / 6200	(JIS)	KRB100-TOS	(EIA)	KRB2-TOS

[CAUTION] In case of use for combining more than 2 sets of High Voltage Scanner unit and Ground Bond Tester, it is required to rack mount or locate these units to the side of Hipot/Insulation Resistance Tester, and it should not be piled up more than 2 sets of High Voltage Scanner units.

For Multiple Channel Testing by High Voltage Scanner···

Example of system consisting TOS9201 and TOS9221 × 2sets (8CH)



Item	Model	cable length	Reguired numbers
① High-Voltage Scanner	TOS9221		2 pc.
② Hipot / Insulation Resistance Tester AC/DC	TOS9201		1 pc.
③ Interface cable	85-50-0210	0.5 m *1	2 pc.
④ High-Voltage Test Lead (red)	TL07-TOS	1.5 m	8 pc.
⑤ High-Voltage Leads for Parallel connection	TL06-TOS	0.5 m *2	2 set

*1: If the length of cable is required more than 0.5m , please contact with our local distributor.
*2: Also available for 1.5 m(59.06 lbs) cable, TL04-TOS

[Rack mount bracket]

TOS9200 / 9201	(JIS)	KRB150-TOS	(EIA)	KRB3-TOS
TOS9220 / 9221	(JIS)	KRB100-TOS	(EIA)	KRB2-TOS

[CAUTION] In case of using more than 2 sets of High Voltage Scanner, it is required to rack mount or locate these units to the side of Hipot/Insulation Resistance Tester, and it should not be piled up more than 2 sets of High Voltage Scanner units.

TOS9200 Series Specifications

Hipot Test Mode

Item			TOS9200	TOS9201
Output section				
AC	Output-voltage range		0.05 kV to 5.00 kV AC	
		Resolution	10 V	
		Accuracy	±(1.5% of setting + 20 V) [with no load]	
	Maximum rated load *1		500 VA (5 kV/100 mA)	
	Maximum rated current		100 mA [output voltage of 0.2 kV or more]	
	Transformer capacity		500 VA	
	Output-voltage waveform *2		Sine wave	
		Distortion	2% or less [with no load or pure resistive load at output voltage of 0.5 kV or more applied]	
	Frequency		50 Hz/60 Hz	
		Accuracy	±0.1%	
	Voltage regulation		±3% or less [maximum rated load → no load]	
	Short-circuit current		200 mA or more, 350 mA or less [at output voltage of 0.5 kV or more]	
	Type of output		PWM switching	
DC	Output-voltage range		—	0.05 kV to 6.00 kV DC
		Resolution	—	10 V
		Accuracy	—	±(1.5 % of the setting + 20 V)
	Maximum rated load *1		—	50 W (5 kV/10 mA)
	Maximum rated current		—	10 mA
	Ripple	No load at 5 kV	—	50 Vp-p Typ.
		Maximum rated load	—	150 Vp-p Typ.
	Voltage regulation		—	1 % or less [maximum rated load → no load]
	Short-circuit current		—	40 mA Typ.
	Discharge function		—	Forced discharge at the end of test(discharge resistance: 125 kΩ)
Start voltage			The voltage at the start of the test can be set as the start voltage.	
		Setting range	0 % to 99 % of the test voltage (resolution of 1 %)	
Output-voltage monitoring function			If the output voltage exceeds ±(10 % of the setting + 50 V), output is cut off and the protection function activates.	
Voltmeter				
Analog		Scale	6 kV AC/DC F.S	
		Accuracy	±5 % F.S	
		Indicator	Mean-value responsive/root-mean-square value scale	
Digital		Measurement range	0.0 kV to 6.00 kV AC/DC	
		Resolution	10 V	
		Accuracy	±(1.0% of the reading + 30 V)	
		Response	Mean-value responsive/root-mean-square value display (response time of 200 ms)	
		HOLD function	The voltage measured at the end of test is held during the PASS and FAIL judgment time period.	

*1 Time limitation on output
The tester's hipot generator is designed to radiate half as much heat as the rated output, in consideration of the size, weight, cost, and other factors of the tester. It is therefore necessary to use the tester within the ranges specified below. Operations deviating from these ranges may heat the output section excessively, thereby activating the protective circuit. In such a case, suspend the test and wait until the temperature falls to the normal level.
[Output limitation in hipot testing (Output time = voltage rise time + test time + voltage fall time)]

Ambient temperature		Upper current	Pause Time	Output time
t ≤ 40 ºC	AC	50< i ≤ 110 mA	At least as long as the output time	Maximum of 30 minutes
		i ≤ 50 mA	Not necessary	Continuous output possible
	DC	5< i ≤ 11 mA	At least as long as the output time	Maximum of 1 minute
		i ≤ 5 mA	At least as long as the judgement wait time (WAIT TIME)	Continuous output possible

*2 Test-voltage waveform
When an AC test voltage is applied to a capacitive load, it is possible that the voltage becomes higher even than that when in the no load state. Furthermore, waveform distortion also may occur if the capacitance of the load is voltage-dependent (such as of ceramics capacitors). When the test voltage is not higher than 1.5 kV and the capacitance is not larger than 1000 pF, such test voltage changes are only of negligible levels. As the output type of the high-voltage generator block of the tester is PWM switching, switching noise and spike noise that the test voltage includes increase when the test voltage is 500 V or less. The lower the test voltage is, the more the waveform distortion increases.

Item		TOS9200	TOS9201
Ammeter *3			
Measurement range		0.00 mA to 110 mA AC	0.00 mA to 110 mA AC/0.00 mA to 11 mA DC
Display		i < 1 mA: □□□ µA; 1 mA ≤ i < 10 mA: □.□□ mA; 10 mA ≤ i < 100 mA: □□.□ mA; 100 mA ≤ i: □□□ mA (i = measured current)	
Accuracy		±(3% of the reading + 20 µA) [after the offset cancel function is activated, if the scanner is mounted]	
Response		Mean-value responsive / root-mean-square value display (response time of 200 ms)	
Hold function		The measured current at the end of the test is held during the PASS judgment time period.	
Offset cancel function		The current flowing to the insulation resistor between the output cables and the stray capacity is cancelled up to 100 µA/kV (in AC hipot testing only).	
Calibration		Performs calibration using the root-mean-square value of a sine wave with a pure resistive load	
Selection of LOW/GUARD for the GND *4		Selection permitted for current measurement between the mode for the GND point connected to the LOW terminal,and the mode using guard.	
	LOW	Connects the GND point to the LOW terminal. Measures the current flowing to the LOW terminal (chassis) (for normal operation).	
	GUARD	Sets the GND point as guard. Measures the current flowing to the LOW terminal, but does not measure the current flowing to the chassis (for high-sensitivity, high-accuracy measurements).	
Time			
Setting range for the voltage rise time (RISE TIME)		0.1 s to 200 s	
Setting range for the voltage fall time (FALL TIME)		0 s to 200 s (Valid only with PASS judgement)	0 s to 200 s (Valid only with PASS judgementin AC hipot testing)
Setting range for the test time (TEST TIME)		0.3 s to 999 s With the TIMER OFF function	
Setting range for the judgement wait time (WAIT TIME)		—	0.3 s to 10 s (Only for DC hipot testing)[RISE TIME + TEST TIME > WAIT TIME]
Accuracy		± (100 ppm + 20 ms)	

TOS9200 Series Specifications

Item	TOS9200	TOS9201
Judgement function		
Judgement method/action	See table below	
Setting range for the upper current (UPPER)	0.01 mA to 110 mA AC	0.01 mA to 110 mA AC / 0.01 mA to 11 mA DC
Setting range for the lower current(LOWER)	0.01 mA to 110 mA AC(With the LOWER OFF function)	0.01 mA to 110 mA AC /0.01 mA to 11 mA DC (With the LOWER OFF function)
Judgement accuracy *3	±(3% of setting + 20 µA) [After the offset cancel function is activated, if the scanner is mounted]	
Current detection method	The absolute current values are integrated and compared with the reference value.	
Response-speed switching function	The current-detection response speed for UPPER FAIL judgement can be set to FAST/MID/SLOW (for AC hipot testing only).	

Judgement	Judgement method	Display	Buzzer	SIGNAL I/O
UPPER FAIL	When the tester detects a current exceeding the upper current, it cuts off the output and makes an UPPER FAIL judgement. In DC hipot testing, however, no judgement is made until the judgement wait time (WIT TIME) has elapsed.	The FAIL LED lights up. Displayed on the LCD	ON	Outputs the U FAIL signal
LOWER FAIL	When the tester detects a current below the lower current, it cuts off the output and makes a LOWER FAIL judgement. However, no judgement is made during the voltage rise time (RISE TIME) or voltage fall time (FALL TIME) in AC hipot testing.	The FAIL LED lights up. Displayed on the LCD	ON	Outputs the L FAIL signal
PASS	When the preset time has elapsed without any abnormalities, the tester cuts off the output and makes a PASS judgement.	The PASS LED lights up. Displayed on the LCD	ON	Outputs the PASS signal

- The PASS signal is output at the timing preset on PASS HOLD. If HOLD is set, the PASS signal is output continuously until the STOP signal is input.
- The UPPER FAIL signal and the LOWER FAIL signal are output continuously until the STOP signal is input.
- The FAIL and PASS buzzer volumes are adjustable. However, they cannot be adjusted individually, as they are set in common.

*3 In AC hipot testing, a current flows into the stray capacity of measurement leadwire and fixtures. When the optional high-voltage scanner TOS9220/9221 is used, a current of approximately 22 µA/kV flows into the stray capacity of each scanner. The table below shows the approximate currents flowing into such stray capacity.
When the LOW terminal is set to GND, a current flowing into the stray capacity is added for measurement purposes to the current flowing into the DUT. In particular, for high-sensitivity, high-accuracy judgement, it is necessary to add the current flowing into the stray capacity to the lower/upper current.When the LOW terminal is set to FLOAT, the effect of the current flowing into the stray capacity is negligible. If the offset cancel function is used, the current flowing into the stray capacity can be eliminated from the measurement.

Output voltage	1 kV	2 kV	3 kV	4 kV	5 kV
Hanging a 350-mm test lead wire (Typ. value)	2 µA	4 µA	6 µA	8 µA	10 µA
Using the accessory leadwire TL01-TOS (Typ. value)	16 µA	32 µA	48 µA	64 µA	80 µA
High-voltage scanner (Typ. value, not including the test leadwire)	22 µA	44 µA	66 µA	88 µA	110 µA

*4 With the GND set to GUARD, current measurement is disabled if the part of the DUT connected to the LOW terminal is grounded, which poses extreme danger. Never ground the DUT. In ordinary operation, set the GND to LOW.

Insulation Resistance Testing Mode

Item		TOS9200	TOS9201
Output section			
Output-voltage range		-25 V to -1000 V DC	
	Resolution	1 V	
	Setting accuracy	±(1.5 % of Setting + 2 V)	
Maximum rated load		1 W (-1000 V DC/1 mA)	
Maximum rated current		1 mA	
Ripple	1 kV no-load	2 Vp-p or less	
	Maximum rated load	10 Vp-p or less	
Voltage regulation		1 % or less [Maximum rated load → no load]	
Short-circuit current		12 mA or less	
Discharge function		Forced discharge at the end of test (discharge resistance: 25 kΩ)	
Output-voltage monitoring function		If the output voltage exceeds ±(10 % of the setting + 50 V), output is cut off and the protection function activates.	
Voltmeter			
Analog	Scale	6 kV AC/DC F.S	
	Accuracy	±5 % F.S	
	Indicator	Mean-value responsive/root-mean-square value scale	
Digital	Measurement range	0 V to -1200 V	
	Resolution	1 V	
	Accuracy	±(1 % of reading + 1 V)	
Resistance meter			
Measurement range		0.01 MΩ - 9.99 GΩ (Within the maximum rated current range of 1 mA to 50 nA)	
Display		See table below	
Accuracy		See table below	
Hold function		The measured current at the end of the test is held during the PASS period.	
Selection of LOW/GUARD for the GND *5		Selection permitted for current measurement between the mode for the GND point connected to the LOW terminal, and the mode using guard.	
	LOW	Connects the GND point to the LOW terminal. Measures the current flowing to the LOW terminal (chassis) (for normal operation).	
	GUARD	Sets the GND point as guard. Measures the current flowing to the LOW terminal, but does not measure the current flowing to the chassis (for high-sensitivity, high-accuracy measurements).	

R < 10.0 MΩ	10.0MΩ ≤ R < 100.0MΩ	100.0MΩ ≤ R < 1.00GΩ	1.00GΩ ≤ R ≤ 9.99GΩ
□.□□ MΩ	□□.□ MΩ	□□□ MΩ	□.□□ GΩ

R = measured insulation resistance

50 nA ≤ i ≤ 100 nA	100 nA < i ≤ 200 nA	200 nA < i ≤ 1 µA	1 µA < i ≤ 1 mA
± (20 % of reading)	± (10 % of reading)	± (5 % of reading)	± (2 % of reading)

i = measured current

[In the humidity range of 20 %rh to 70 %rh (no condensation), with no disturbance such as swinging of the test leadwire]

TOS9200 Series Specifications

Item	TOS9200	TOS9201
Judgement function		

Judgement method/action

Judgement	Judgement method	Display	Buzzer	SIGNAL I/O
UPPER FAIL	When the tester detects a resistance exceeding the upper cutoff resistance, it cuts off the output and makes an UPPER FAIL judgement. However, no judgement is made during a voltage rise time (RISE TIME).	The FAIL LED lights up. Displayed on the LCD	ON	Outputs the U FAIL signal
LOWER FAIL	When the tester detects a resistance below the lower cutoff resistance, it cuts off the output and makes a LOWER FAIL judgement. However, no judgement is made until the judgement wait time (WAIT TIME) has elapsed.	The FAIL LED lights up. Displayed on the LCD	ON	Outputs the L FAIL signal
PASS	When the preset time has elapsed without any abnormalities, the tester cuts off the output and makes a PASS judgement.	The PASS LED lights up. Displayed on the LCD	ON	Outputs the PASS signal

- The PASS signal is output at the timing preset on PASS HOLD. If HOLD is set, the PASS signal is output continuously until the STOP signal is input.
- The UPPER FAIL signal and the LOWER FAIL signal are output continuously until the STOP signal is input.
- The FAIL and PASS buzzer volumes are adjustable. However, they cannot be adjusted individually, as they are set in common.

Setting range for the upper resistance (UPPER)	0.01 MΩ to 9.99 GΩ [Below the maximum rated current]
Setting range for the lower resistance (LOWER)	0.01 MΩ to 9.99 GΩ [Below the maximum rated current]

Judgement accuracy For both UPPER and LOWER

Judgement current		50 nA ≤ i ≤ 100 nA	100 nA < i ≤ 200 nA	200nA < i ≤ 1 µA	1 µA < i ≤ 1 mA
UPPER, LOWER	0.01 ≤ R < 10.0 MΩ	—	—	—	± (2 % of setting + 3digit)
	10.0 ≤ R < 50.0 MΩ	—	—	± (5 % of setting + 5digit)	± (2 % of setting + 3digit)
	50.0 ≤ R < 100 MΩ	—	—	± (5 % of setting + 5digit)	± (2 % of setting + 3digit)
	100 MΩ ≤ R < 200 MΩ	—	± (10 % of setting + 5digit)	± (5 % of setting + 5digit)	± (2 % of setting + 3digit)
	200 MΩ ≤ R < 500 MΩ	± (20 % of setting + 5digit)	± (10 % of setting + 5digit)	± (5 % of setting + 5digit)	± (2 % of setting + 3digit)
	500 MΩ ≤ R < 1.00 GΩ	± (20 % of setting + 5digit)	± (10 % of setting + 5digit)	± (5 % of setting + 5digit)	± (2 % of setting + 3digit)
	1.00 GΩ ≤ R < 2.00 GΩ	± (20 % of setting + 10digit)	± (10 % of setting + 5digit)	± (5 % of setting + 5digit)	—
	2.00 GΩ ≤ R < 5.00 GΩ	± (20 % of setting + 20digit)	± (10 % of setting + 10digit)	± (5 % of setting + 5digit)	—
	5.00 GΩ ≤ R < 10.0 GΩ	± (20 % of setting + 20digit)	± (10 % of setting + 10digit)	—	—

Judgement current = test voltage/(UPPER,LOWER)
[In the humidity range of 20 %rh to 70 %rh (no codensation), with no disturbance such as swinging of the test leadwire]
[In LOWER judgement, at least 0.5 s is necessary for testing after the WAIT TIME has elapsed. In LOWER judgement for 200 nA or lower, a wait time of at least 1.0 s is necessary.]

Time	
Setting range for the voltage rise time (RISE TIME)	0.1 s to 200 s
Setting range for the test time (TEST TIME)	0.5 s to 999 s With the TIMER OFF function
Setting range for the judgement wait time (WAIT TIME)	0.3 s to 10 s [RISE TIME + TEST TIME > WAIT TIME]
Accuracy	± (100 ppm + 20 ms)

*5 When the GND is set to GUARD, current measurement is disabled if the part of the DUT connected to the LOW terminal is grounded, which poses extreme danger. Never ground the DUT. In ordinary operation, set the GND to LOW.

General Specifications

Item		TOS9200	TOS9201
Environment			
Installation location		Indoors at an altitude of up to 2000 m	
Warranty range	Temperature	5 °C to 35 °C	
	Humidity	20 %rh to 80 %rh (No condensation)	
Operating range	Temperature	0 °C to 40 °C	
	Humidity	20 %rh to 80 %rh (No condensation)	
Storage range	Temperature	-20 °C to 70 °C	
	Humidity	90 %rh or less (No condensation)	
Power requirements			
Nominal voltage range (Allowable voltage range)		100 V to 120 V AC/200 V to 240 V AC (85 V to 130 V AC/170 V to 250 V AC) Selectable	
Power consumption	Using no load (READY)	100 VA or less	
	Using the rated load	Maximum of 800 VA	
Allowable frequency range		47 Hz to 63 Hz	
Insulation resistance		30 MΩ or more (500 V DC) [between the AC LINE and chassis]	
Hipot		1390 V AC, 2 seconds, 20 mA or less [between the AC LINE and chassis]	
Ground bond		25 A AC/0.1 Ω or less	
Electromagnetic compatibility (EMC) *6		Conforms to the requirements of the following directive and standard. EMC Directive 2004/108/EC, EN61326, EN61000-3-2, EN61000-3-3 Under following conditions 1. Used test leadwire TL01-TOS which is supplied. 2. No discharge occurs at outside of the tester. 3. Used the shielded cable which length is less than three meters when the SIGNAL I/O is used.	
Safety *6 *7		Conforms to the requirements of the following directive and standard. Low Voltage Directive 2006/95/EC , EN61010-1, Class I, Pollution degree 2	
Dimensions (maximum)		430 (455) W x 132 (150) H x 370 (440) D mm	
Weight		Approx. 19 kg	

TOS9200 Series Specifications

Item	TOS9200	TOS9201
Accessory		
AC Power cable	1 pc.	
High-voltage test lead wire TL01-TOS (1.5 m)	1 set	
Interlock jumper	1 pc.	
High-Voltage Danger seal	1 sheet	
Fuse	1 pc.	
Operation Manual	Operation Manual for Tester: 1 copy, Operation for GPIB/RS-232C Interface: 1 copy	

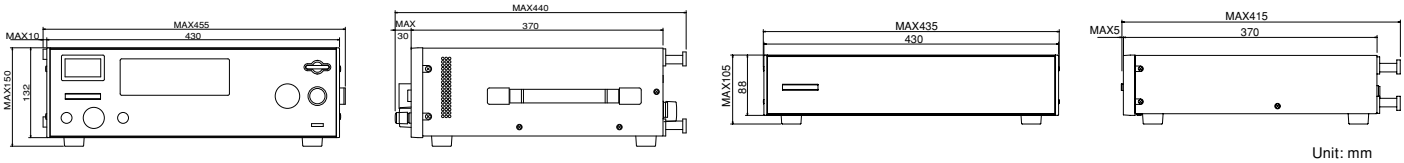
*6 Only on models that have CE marking on the panel. Not applicable to custom order models.
*7 This instrument is a Class I equipment. Be sure to ground the protective conductor terminal of the instrument. The safety of the instrument is not guaranteed unless the instrument is grounded properly.

High-voltage scanner (TOS9220/9221)

Item		TOS9220	TOS9221
Maximum rating voltage	AC	5.0 kV	
	DC	6.0 kV	
Number of channels		4 (Each channel is settable to HIGH, LOW, or OPEN.)	
Maximum number of scanners connected		4 scanners,Channel numbers are determined in order of connection to the TOS9200/9201 tester. 1 st scanner CH1 to CH4 2 nd scanner CH5 to CH8 3 rd scanner CH9 to CH12 4 th scanner CH13 to CH16	
Contact check function		None *1	Provided
Lamps and LEDs	POWER	Lights as it is interlocked with the POWER switch of the TOS9200/9201 tester	
	DANGER	Lights as it is interlocked with the DANGER lamp of the TOS9200/9201 tester	
	CHANNEL	Lights during a test at each channel HIGH: red; LOW: green; Under contact check: orange	
Power requirements			
Nominal voltage range (allowable voltage range)		100 V to 120 V AC/200 V to 240 V AC (85 V to 132 V AC/170 V to 250 V AC) Automatic switching	
Power consumption	In READY state	Approx. 12 VA	
	During test	40 VA maximum	
Allowable frequency range		47 Hz to 63 Hz	
Insulation resistance		30 MΩ or more (500 V DC) [between the AC LINE and chassis]	
Hipot		1390 V AC, 2 seconds, 10 mA or less [between the AC LINE and chassis]	
Ground bond		25 A AC/0.1 Ω or less	
Electromagnetic compatibility (EMC) *2		Conforms to the requirements of the following directive and standard. EMC Directive 89/336/EEC, EN61326, EN61000-3-2, EN61000-3-3 Under following conditions 1. Used test leadwire TL07-TOS which is supplied. 2. No discharge occurs at outside of the tester. 3. Used the shielded cable which length is less than three meters when the SIGNAL I/O is used.	
Safety *2 *3		Conforms to the requirements of the following directive and standard. Low Voltage Directive 73/23/EEC, EN61010-1, Class I, Pollution degree 2	
Environment			
Installation location		Indoors and at altitudes up to 2000 m	
Warranty range	Temperature	5 °C to 35 °C	
	Humidity	20 %rh to 80 %rh (no condensation)	
Operating range	Temperature	0 °C to 40 °C	
	Humidity	20 %rh to 80 %rh (no condensation)	
Storage range	Temperature	-20 °C to 70 °C	
	Humidity	90 %rh or less (no condensation)	
Dimensions		430(435)W × 88(105)H × 370(415) Dmm	
Weight		Approx. 6.5 kg	
Accessories			
AC power cable		1 pc.	
High-voltage test leadwires, red		4 pc. (1.5 m each)	8 pc. (1.5 m each)
High-voltage leads for parallel connection		1 set (0.5 m each)	
Interface cable		1 pc.(0.5 m)	
Channel-indication stickers		For the panel face: 1 sheet; for the test leadwires: 1	
“HIGH VOLTAGE, DANGER” stickers		2 sheets	
Fuses		2 pc. (including a spare contained in the fuse holder)	
Operation Manual		1 copy	

*1 When the contact check function is activated on the TOS9220/9201 tester, the tester conducts a con-tact check up to the output terminals of the TOS9220 scanner.
*2 Only on models that have CE marking on the panel. Not applicable to custom order models.
*3 This instrument is a Class I equipment. Be sure to ground the protective conductor terminal of the instrument. The safety of the instrument is not guaranteed unless the instrument is grounded properly.
[Measurement accuracy achieved when the scanner and the TOS9220/9201 tester are connected]
In an AC hipot test, a current of approx. 22 µA/kV flows per scanner due to stray capacitance in the scanner in comparison with use of the TOS9220/9201 tester alone. Note that this current may contribute to errors in current measurements conducted by the TOS9220/9201 tester.

External Dimensional Diagrams



Unit: mm

TOS9213S Specifications

*The highlighted text in blue indicates the improved specification exclusively applied to the PV module testing.

Withstanding Voltage Test Mode

Output section(DC)		
Output-voltage range		0.05 V to 10.0 kV
	Resolution	10 V
	Accuracy	±(1.5 % of setting +20 V)
Maximum rated load *1		50 W(10 kV/5 mA)
Maximum rated current		5 mA
Ripple	No load at 10kV	100 Vp-p Typ.
	Maximum rated load	100 Vp-p Typ.
Voltage regulation		1 % or less [maximum rated load → no load]
Short-circuit current		40 mA Typ.
Discharge function		Forced discharge at the end of test (discharge resistance: 500 k) The discharge time can be set to a value from 0.5 s to 300 s. *2
Start voltage		The voltage at the start of the test can be set as the start voltage.
	Setting range	0 % to 99 % of the test voltage (resolution of 1 %)
Output-voltage monitoring function		If the output voltage exceeds ±(10 % of setting + 50 V), output is cut off and the protection function activates.
Voltmeter		
Analog	Scale	10 kV DC F.S
	Accuracy	±5 % F.S
	Indicator	Mean-value responsive
Digital	Measurement range	0.00 to 10.5 kV DC
	Resolution	10 V
	Accuracy	±(1.0 % of reading + 20 V)
	Response	Mean-value responsive (response time of 200 ms)
	HOLD function	The voltage measured at the end of test is held during the PASS and FAIL period.

*1 Limitation on output
The tester's withstanding voltage generator is designed to radiate half as much heat as the rated output, in consideration of the size, weight, cost, and other factors of the tester. It is therefore necessary to use the tester within the ranges specified below. Operations deviating from these ranges may heat the output section excessively, thereby activating the protective circuit. In such a case, suspend the test and wait until the temperature falls to the normal level.

Output limitation in withstanding voltage testing

Ambient temperature		Upper reference	Pause	Output time
t ≤ 40 ℃	DC	2.5 mA < i	At least as long as the output time	Maximum of 1 minute
		i ≤ 2.5 m A	At least as long as the judgement wait time (WAIT TIME)	Continuous output possible

[Output time = voltage rise time + test time + voltage fall time]

*2 About the discharge time settingIf
you set the discharge time to 0.0 s or if the voltage between the output terminals exceeds approximately 30 V even after the specified discharge time has passed, the TOS9213S will continue discharging until the voltage between the output terminals falls below approximately 30 V.

Ammeter	
Measurement range	0.00 mA to 5.5 mA DC
Accuracy *3	0 µA to 2.00 mA: ±(3 % of reading + 5 µA) 2.01 mA to 5.50 mA: ±(3 % of reading +10 µA)
Responce	Mean-value responsive (response time of 200 ms)
Hold function	The measured current at the end of the test is held during the PASS period.

Judgement function	
Setting range for the upper reference (UPPER)	1 µA to 999 µA 1 µA STEP 1.00 mA to 5.50 mA 0.01 mA STEP
Setting range for the lower ref-erence (LOWER)	1 µA to 999 µA 1 µA STEP 1.00 mA to 5.50 mA 0.01 mA STEP (With the LOWER OFF function)
Judgement accuracy *3	0 µA to 2.00 mA: ±(3 % of setting + 5 µA) 2.01 mA to 5.50 mA: ±(3 % of setting + 10 µA)
Response switching function	The current detection response for UPPER FAIL judgement can be set to FAST/MID/SLOW *4
Time	
Setting range for the voltage rise time (RISE TIME)	0.1 s to 200 s
Setting range for the test time (TEST TIME)	0.3 s to 999 s (With the TIMER OFF function)

*3 When the GND LOW/GUARD setting is set to LOW, the humidity must not exceed 70 % rh.
*4 In the MID and SLOW modes, depending on the discharge method, the voltage monitoring function may operate and the TOS9213S may enter the PROTECTION status before UPPER FAIL detection takes place.

Insulation Resistance Testing Mode

Output section		
Output-voltage range		-25 V to -1000 V
	Resolution	1 V
	Accuracy	±(1.5 % of setting+2 V)
Maximum rated load		1 W(-1000 V/1 mA)
Maximum rated current		1 mA
Ripple	1 kV no-load	2 Vp-p or less
	Maximum rated load	10 Vp-p or less
Voltage regulation		1 % or less [Maximum rated load no load]
Short-circuit current		12 mA or less
Discharge function		Forced discharge at the end of test (discharge resistance: 25 k Ω)The discharge time can be set to a value from 0.5 s to 300 s. *2
Output-voltage monitoring function		If the output voltage exceeds ±(10 % of the setting + 50 V), output is cut off and the protection function activates.
Voltmeter		
Analog	Scale	10 kV DC F.S
	Accuracy	±5 % F.S
	Indicator	Mean-value responsive
Digital	Measurement range	0 to -1200 V
	Resolution	1 V
	Accuracy	±(1.0 % of reading +1 V)
Resistance meter		
Measurement range		0.01 M - 9.99 G (Within the maximum rated current range of 1 mA to 50 mA)
Accuracy		

50 nA ≤ i ≤ 100 nA	100 nA < i ≤ 200 nA	200 nA < i ≤ 1 µA	1 µA < i ≤ 1 mA
±(20 % of reading.)	±(10 % of reading.)	±(5 % of reading.)	±(2 % of reading.)

[i=measured current]
[In the humidity range of 20 % to 70 % R.H (no condensation), with no disturbance such as swinging of the test leadwire]

Judgement function		
Judgement method		The UPPER/LOWER judgement can be switched between the resistance value-based judgement and current value-based judgement. The action for the judgement method by the current valued-based judgement, Display, Buzzer, SIGNAL I/O can be referred to the action in Withstanding Voltage Test Mode.
Setting range for the upper reference(UPPER)	Resistance value-based judgment	0.01 M to 9.99 G [Below the maximum rated current]
	Current value-based judgment	0.1 µA to 1.00 mA
Setting range for the lower reference (LOWER)	Resistance value-based judgment	0.01 M to 9.99 G [Below the maximum rated current]
	Current value-based judgment	0.1 µA to 1.00 mA
Time		
Setting range for the voltage rise time (RISE TIME)		0.1 s to 200 s
Setting range for the test time(TEST TIME)		0.5 s to 999 s(With the TIMER OFF function)

General Specifications

Power requirements	Nominal voltage range (Allowable voltage)	100 V to 120 V AC/200 V to 240 V AC (85 V to 130 V AC/170 V to 250 V AC) Selectable
Power con-sumption	Using no load (READY)	100 VA or less
	Using the rated load	Maximum of 200 VA
Allowable frequency range		47 Hz to 63Hz
Insulation resistance		30 M Ω or more (500 V DC) [between the AC LINE and chassis]
Withstanding voltage		1390 V AC, 2 seconds, 20 mA or less [between the AC LINE and chassis]
Earth continuity		25 A AC/0.1 Ω or less
Safety		Conforms to the requirements of the following standard. IEC 61010-1 Class I Pollution degree 2
Warranty range	Temperature/Humidity	5 °C to 35 °C/20 % to 80 % rh (No condensation)
Operating range	Temperature/Humidity	0 °C to 40 °C/20 % to 80 %rh (No condensation)
Storage range	Temperature/Humidity	-20 °C to 70 °C/90 % RH or less (No condensation)
Dimensions		430(455)W×132(150)×400(440)Dmm
Weight		Approx. 13 kg (Approx. 28.66 lb)
Accessory		AC Power cord 1 pc., High-voltage test leadwire TL01-TOS (1.5 m)1 set, Interlock jumper 1 pc., HIGH VOLTAGE DANGER sticker 1 sheet, Fuse 1pc., Operation Manual 1 copy

Hipot Tester (AC/DC)

TOS5101

CE

Dimensions / Weight

430(16.93″)W × 177(6.97″)H × 370(14.57″)Dmm / 24kg(52.91 lbs)

Accessories

High-voltage test lead: TL01-TOS (max.allowablevoltage: 5 kV/1.5 m), TL03-TOS (max.allowablevoltage: 10 kV/1.5 m)

High-end model of TOS Series having AC, DC10 kV output

TOS Series (TOS5101/5051/5050) are designed exclusively for Hipot testing of electronic equipment and components conforming to various safety standards. The use of a high luminance, large fluorescent display tube for the display enables data including measured values, status and judgment results to be extremely legible. The PASS/FAIL function employs a window comparator method that enables TOS5101 to make fail judgment of current leakage over the upper reference value and below the lower reference value which can be set on the front panel.

Thus, highly reliable testing can be performed including that for test lead disconnection and defective contact. In addition, in order to prevent erroneous operation and accidents, the TOS5101 is also equipped with a Key Lock function and Interlock function, a high-voltage output terminal having a narrowed insertion port, a large DANGER lamp, and an automatic discharge function (during DC operation) that removes charge from the test piece. These features give the TOS5101 a high degree of safety and reliability.

*In general, when the capacitance of DUT has a voltage dependence (such as a “High-dielectric constant ceramic capacitor”), please take a caution that the waveform distortion may occurs.

Features

- Complies with various safety standards
- AC/DC output (0 kV to 10 kV)
- Large color display
- Digital voltmeter and ammeter
- Digital timer
- Window comparator type employed for PASS/FAIL judgement.
- Equipped with remote control function
- Various signal outputs
- Automatic discharge function (during DC operation)
- Provided with zero turn-on switch
- Compact size

TOS5101 Specifications

Output block		
Applied Voltage		0 to 5/0 to 10 kV AC and DC
AC		
Maximum Rated *1		500 VA/10 kV, 50 mA
Waveform		Commercial line waveform
Voltage Regulation		Max. 15 % (for max. rated load to no load)
Switching		Use of a zero turn-on switch
DC		
Applied Voltage		50 W/10 kV, 5 mA
Ripple		100 Vp-p typ. at 10 kV, no load 200 Vp-p typ. at max. rated output
Maximum Rated *1		Max. 3 % (for max. rated load to no load)
Output Voltmeters		
Analog	Scale	10 kV full scale , AC/DC
	Class	JIS Class 2.5
	Accuracy	±5 % of full scale
	AC Indication	Mean value response / rms value scale
Digital	Full Scale	5 kV/10 kV full scale
	Accuracy	±1.5 % of full scale
	AC Response	Mean value response/rms value display
Ammeter		
Digital	Accuracy	±(5 % + 20 μA) of upper cutoff current
	AC Response	Mean value response/rms value display
Pass/fail Judgement Function		
Type of Judgement		Window comparator type ●FAIL judgement *When current detected above upper cutoff current *When current detected below lower cutoff current (FAIL signal generated when FAIL judgement made) ●PASS judgement *When set time has elapsed and no abnormality is detected
Upper cutoff current setting range		AC: 0.1 to 55 mA DC: 0.1 to 5.5 mA
Lower cutoff current setting range		AC: 0.1 to 55 mA DC: 0.1 to 5.5 mA
Judgement Accuracy		±(5 % of upper cutoff current + 20 μA)
Current Detection		Integration of current absolute value followed by comparison with reference value.
Calibration		With rms value of sine wave using a pure resistance load.
No-load output voltage required for detection		Approx. 970 V when set to 50 mA AC
		Approx. 160 V when set to 5 mA DC
Test Time Setting Range		0.5 to 999 sec (±10 ms) (timer-off function provided)
Accuracy		±20 ms
Line Voltage		220 V to 240V, 50/60 Hz
Power Requirements		
for line voltage of 220 V to 240 V		Max. 50 VA under no-load conditions /Approx. 610 VA at rated load
Electromagnetic compatibility (EMC) *3		Conforms to the requirements of the following directive and standard.*2 EMC Directive 89/336/EEC EN61326 EN61000-3-2 EN61000-3-3 Under following conditions 1. Used HV test leadwires which is supplied. 2. No discharge in testing. 3. Used the shielded cable which length is less than three meters when the SIGNAL I/O is used.
Safty *3		Conforms to the requirements of the following directive and standard. *2 *4 Low Voltage Directive 73/23/EEC EN61010-1 Class I Pollution degree 2
Insulation resistance		30 M Ω or more (500 V DC)
Hipot		1390 VAC, 2 seconds [between the AC LINE and chassis]
		1200 VAC, 1 second [UL-approved products only]
Environment		Specification range: 5 °C to 35°C/20 %rh to 80 %rh
		Operable range: 0 °C to 40°C/20 %rh to 80 %rh
		Storage range: -20 °C to 70 °C/80 %rh or less
Dimensions (MAX)		430 W × 177(195) H × 370(450)D mm
Weight		
for line voltage of 220 V to 240 V		Approx. 24 kg
Accessories		
High-voltage test lead		TL01-TOS (max.allowablevoltage: 5 kV/1.5 m) TL03-TOS (max.allowablevoltage: 10 kV/1.5 m)
Others		14-pin amphenol plug (assembled)

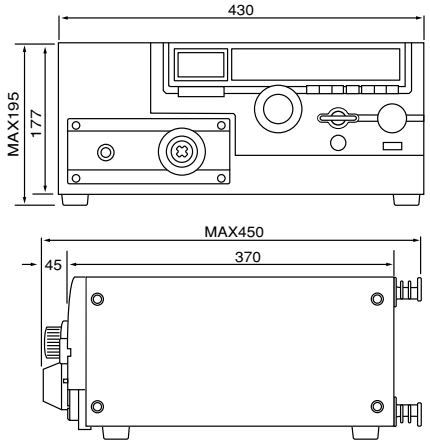
*1 Continuous output time may be limited depending on current high limit reference value and ambient temperature.

*2 Only on models that have CE marking on the panel. Not applicable to custom order models.

*3 Not applicable to custom order models.

*4 This instrument is a Class I equipment. Be sure to ground the protective conductor terminal of the instrument. The safety of the instrument is not guaranteed unless the instrument is grounded properly.

External Dimensional Diagrams



Unit: mm

Hipot Tester / Hipot Tester with Insulation Resistance Test

TOS5300 Series

USB CE

NEW

TOS5301

TOS5300

TOS5302

A new standard for Hipot & Insulation resistance testing Applied to World-Wide input voltage

The TOS5300 Series are test instruments used in Hipot tests and insulation resistance tests, two of the four tests regarded as necessary for ensuring the safety of electrical products. With an output of 5 kV/100 mA (AC) and 6 kV/50 W (DC), the series can be used in Hipot & insulation resistance testing of electronic equipment and electronic parts, based on the requirements of IEC, EN, UL, VDE, JIS, and other international safety standards and the Electrical Appliance and Material Safety Law. Also, the test voltage stability is improved with the adoption of a newly developed switching amplifier. Since the output voltage can be kept constant even when the AC line voltage or frequency changes, consistent testing can be performed, even when the power supply environment is in an unstable region. The TOS5300 is also equipped with a number of features that are capable of meeting a variety of test needs. It is a new low-cost standard model that provides thorough operability, reliability and safety.

Dimensions / Weight

TOS5302: 320(12.60″)W × 132(5.20″)H × 350(13.78″)Dmm / 14kg(30.9 lbs)
TOS5301: 320(12.60″)W × 132(5.20″)H × 350(13.78″)Dmm / 15kg(33.1 lbs)
TOS5300: 320(12.60″)W × 132(5.20″)H × 350(13.78″)Dmm / 14kg(30.9 lbs)

Accessories

Power cord, High-voltage test lead wire: TL31-TOS, High-voltage warning sticker, D-sub 25-pin plug, User's Manual, CD-R(Contains the Communication Interface Manual, the KI-VISA library, and the Safety evalution test.)

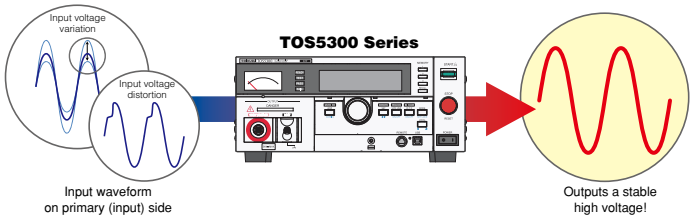
Features

TOS5302: ■Hipot (Withstanding voltage): AC 5 kV/100 mA
Insulation Resistance: 25 V - 1000 V
TOS5301: ■Hipot (Withstanding voltage): AC 5 kV/100 mA, DC 6 kV/50 W
TOS5300: ■Hipot (Withstanding voltage): AC 5 kV/100 mA
Common: ■The PWM amp system provides highly-stable output
■High-precision measurement ± 1.5 % of reading
■Rise/Fall time control function
■Key lock function and Protection cover on the panel operation
■Limit voltage function
■Monitoring output voltage function
■Calibration due notice and warning function
■Equipped with USB interface

Features and Functions

■ The PWM amplifier provides highly stable output! [Input voltage variation: ± 0.3 %]

The TOS5300 Series equips with a high-efficient PWM amplifier that can output a stable high-voltage without being affected by the variation of AC power line, users can perform "safe", "stable", and highly "reliable" tests with confidence, even in regions with large voltage variations.



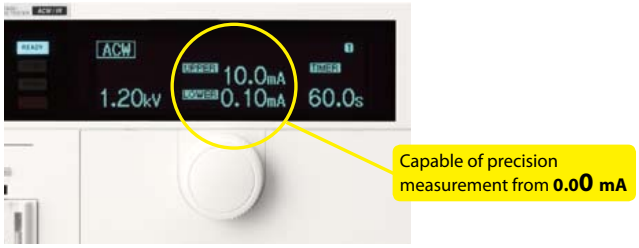
■ 6 kV/50 WDC Hipot (Withstanding voltage) test [Model TOS5301]

Capable to perform DC Hipot (Withstanding voltage) test up to 6 kV. (Model TOS5301) Equipped with a stable DC/DC converter with a low-ripple and the load variation of 3 % or less.

■ Realizing high-precision measurement with high-resolution and high-speed judgement

Equipped with a high-accuracy, high-resolution of True RMS measurement circuit, including a Voltmeter with ± 1.5 % of reading (500 V or greater)/ minimum resolution of 1V, and an Ammeter with ± 1.5 % of reading (1 mA or more)/minimum resolution of 1 µA.

In addition, it is also equipped with an Auto range function, with achieving a judgment accuracy of ± 1.5 % of reading. The Lower limit judgment accuracy achieves a level of performance equivalent to the Upper limit judgment accuracy that enables to detect for such a poor contact or disconnections of test leads. Moreover, it realizes the fast judgment by the test time of 0.1 second, while reliable testing can be performed, thanks to high-precision, high-resolution, high-speed measurement and the judgment functions.



▲ AC Hipot (Withstanding voltage) test settings display (example)

Features and Functions

■ Insulation resistance test for 25 V to 1000 V* [Model TOS5302]

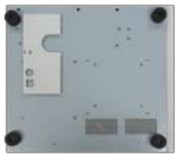
The TOS5302 is equipped with an insulation resistance tester. The test voltages can be set from 25 V, 50 V, 100 V, 125 V, 250 V, 500 V and 1000 V. And for setting at 500 V and above, it can perform the insulation resistance test up to 5.00 G.

*At 500 V and above, measurements up to 5.00 GΩ are possible.

■ Protection cover prevents physical operation error in the production site

In many cases, workers on electronic equipment production lines and inspection lines are not technical experts. Therefore, it is possible that the operators may change setting conditions and make operation errors. In order to prevent from such cases, the TOS5300 is equipped with a key lock function and a protection cover to disable a physical key operation from the front panel.

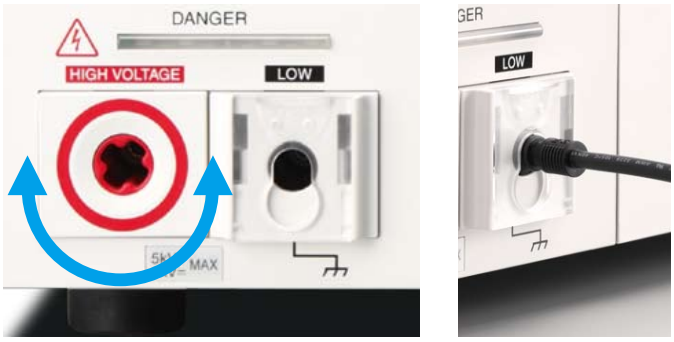
▲ View with the protection cover removed



▲ Storing the protection cover for the key operation to the base of unit.

■ New design of output terminal improves safety and functionality

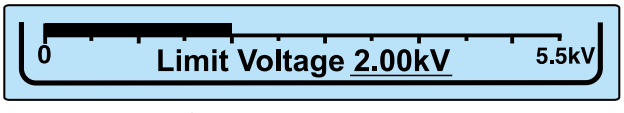
The free rotation machanisim protects from twisting (or breaking) of the cable. Also, with having the lock function for the LOW terminal on the main unit, the metal plate is no longer attached to the test lead of LOW-side, and it makes to resist damage to the test lead. Because of elimination of these projected components, the TOS5300 can avoid from unexpected accidents such as when the unit travels to other location. And also when the test lead is snagged on something, or unexpected stress is applied on the test lead, the High (High-voltage) test lead is designed to disconnect easily, but the Low (ground) test lead is designed to resist disconnection.



▲ Flat surface design of the HIGH terminal with free rotation mechanism, and the LOW terminal with lock function

■ Limit voltage function

Prevents the user from setting a test voltage that exceeds the preset voltage.



▲ LIMIT VOLTAGE setting (example)

■ Monitoring output voltage function

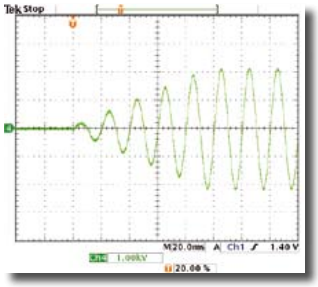
If the output voltage exceeds the setting voltage of (± 350 V), it turns off the output and the system switches to PROTECTION mode.

In order to handle kilo's of high voltage when the Hipot (Withstand voltage) and insulation tests are conducted, there are number of safety measures are required to take place. Having with these functions improve, the operational safety and the protection for the EUT.

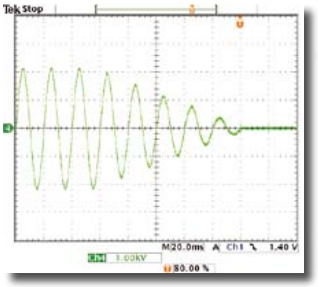
■ Rise/Fall time control function

The Rise time control function enables you to increases the test voltage gradually to reach the setting voltage while the AC Hipot (Withstanding voltage) test is conducted. The voltage rise time can be set from 0.1 s to 10.0 s at a resolution of 0.1 s.

The Fall time control function enables you to decrease the test voltage gradually when the PASS judgment is made at the AC Hipot (Withstanding voltage) test. The voltage fall time is fixed at 0.1 s. (OFF is also selectable).



▲ Rise time control waveform (example)



▲ Fall time control waveform (example)

■ Interlock feature

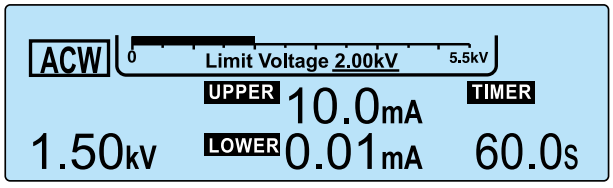
The product is equipped with an interlock function that operates together with external devices to interrupt output. To ensure the safe operation of tester, the interlock function activates when the SIGNAL I/O connector pins number 1 and 13 are opened, and when they are short-circuited, the interlock function is released.

■ Discharge feature [Model TOS5301/TOS5302]

Equipped with a forced discharge function that forcibly discharge the electricity which has been charged in the EUT after the completion of DC Hipot (Withstanding voltage) test or insulation resistance test.

■ Upper limits/Lower limits setting function

It automatically detects connector lead breaks and disconnections of wiring by measuring extremely small amounts of current that flows when voltage is applied to the EUT.



▲ Example setting display of Upper limit, Lower limit, and Test time

■ Calibration due notice and Warning function

To assure the traceability of periodic calibration of the product, this function gives a notice of calibration due managed by the builtin real-time clock. Even if the due data has elapsed, it is possible to avoid the oversight of operator with limiting the operation with a display of warning message.

■ AUTO TEST feature for consecutive testing [Model TOS5302]

The TOS5302 can perform an AC Hipot (Withstanding voltage) test and an insulation resistance test consecutively.

Either of the following can be conducted :

Insulation resistance test → AC Hipot (Withstanding voltage) test, or

AC Hipot (Withstanding voltage) test → Insulation resistance test.

TOS5300 Series Specifications

Unless specified otherwise, the specifications are for the following settings and conditions.
• The warm-up time is 30 minutes. • TYP:These are typical values. These values do not guarantee the performance of the product.
• rdng: Indicates the readout value. • set: Indicates a setting. • f.s: Indicates full scale.

Withstanding Voltage Test Mode

			TOS5300	TOS5301	TOS5302
AC output section	Output range		0.05 kV to 5.00 kV		
		Accuracy	±(2 % of set + 20 V) when no load is connected		
		Setting range	0.00 kV to 5.50 kV		
		Resolution	10 V steps		
	Max. rated output *1		500 VA (5 kV/100 mA)		
	Max. rated voltage		5 kV		
	Max. rated current		100 mA (when the output voltage is 0.5 kV or greater)		
	Transformer rating		500 VA		
	Output voltage waveform *2		Sine		
		Distortion	If the output voltage is 0.5 kV or more: 3 % or less (when no load or a pure resistive load is connected).		
	Frequency		50 Hz or 60 Hz		
		Accuracy	±0.5 % (excluding during voltage rise time)		
	Voltage regulation		10 % or less (when changing from maximum rated load to no load)		
	Input voltage variation		±0.3 % (5 kV when no load is connected; power supply voltage: 90 V to 250 V)		
	Short-circuit current		200 mA or more (when the output voltage is 1.0 kV or greater)		
	Output method		PWM switching		
DC output section	Output range		-	0.05 kV to 6.00 kV	-
		Accuracy		± (2 % of set + 20 V) When no load is connected	
		Setting range		0.00 kV to 6.20 kV	
		Resolution		10 V STEP	
	Max. rated output *1			50 W (5 kV/10 mA)	
	Max. rated voltage			6 kV	
	Max. rated current			10 mA	
	Ripple (TYP)	5 kV when no load is connected		50 Vp-p	
		Max. rated load		100 Vp-p	
	Voltage regulation			3% or less (When changing from maximum rated load to no load)	
	Short-circuit current (TYP)			40 mA (when generation 6 kV output)	
	Discharge feature			Forced discharge after test completion (discharge resistance: 125 kΩ)	
Start Voltage			The voltage at the start of withstanding voltage tests can be set to 50% of the test voltage.		
Limit Voltage			The test voltage upper limit can be set. AC: 0.00 kV to 5.50 kV, DC: 0.00 kV to 6.20 kV		
Output voltage monitor feature			If output voltage exceeds the specified value +350 V or is lower than the specified value - 350 V, output is turned off, and protective features are activated.		
Voltmeter	Analog	Scale	6 kV AC/DC f.s		
		Accuracy	± 5 % f.s		
		Indication	Average value response/rms scale		
	Digital	Measurement range	0.000 kV to 6.500 kV AC/DC		
		Display	□ . □□□ kV		
		Accuracy	V < 500 V: ±(1.5 % of rdng + 20 V); V ≥ 500 V: ±1.5 % of rdng		
		Response	True rms (response time: 50 ms)		
		Hold feature	After a test is finished, the measured voltage is retained until the PASS or FAIL judgment is cleared.		
Ammeter	Digital	Measurement range	AC: 0.00 mA to 110 mA	AC: 0.00 mA to 110 mA DC: 0.00 mA to 11 mA	AC: 0.00 mA to 110 mA
		Display	i = measured current: i < 1 mA: □□□ μA; 1 mA ≤ i < 10 mA: □ . □□□ mA; 10 mA ≤ i < 100 mA: □□ . □□ mA; 100 mA ≤ i: □□□ . □ mA		
		Accuracy *3	1.00 mA ≤ i: ±(1.5 % of rdng); i < 1.00 mA: ±(1.5 % of rdng + 30 μA)		
		Response	True rms (response time: 50 ms)		
		Hold feature	After a test is finished, the measured voltage is retained until the PASS judgment is cleared.		

Withstanding Voltage Test Mode

			TOS5300	TOS5301	TOS5302
Judgment feature	Judgment method and judgment operation		See table below		
	Upper limit setting		AC: 0.01 mA to 110 mA	AC: 0.01 mA to 110 mA DC: 0.01 mA to 11 mA	AC: 0.01 mA to 110 mA
	Lower limit setting		AC: 0.01 mA to 110 mA / OFF	AC: 0.01 mA to 110 mA / OFF DC: 0.01 mA to 11 mA / OFF	AC: 0.01 mA to 110 mA / OFF
	Judgment accuracy *3		1.00 mA ≤ i: ±(1.5 % of set), i < 1.00 mA: ±(1.5 % of set + 30 μA)		
	Current detection method		Calculates the current's true rms value and compares this value with the reference value		
	Calibration		Calibrated with the rms of a sine wave using a pure resistive load		
Time	Voltage rise time		0.1 s to 10.0 s		
		Resolution	0.1 s		
	Voltage fall time		0.1 s / OFF (only enabled when a PASS judgment occurs)		
	Test time		0.1 s to 999 s, can be turned off (TIMER OFF)		
		Resolution	0.1 s to 99.9 s: 0.1 s. 100 s to 999 s: 1 s.		
	Accuracy		±(100 ppm + 20 ms) excluding Fall Time		

Judgment	Judgment method	Display	Buzzer	SIGNAL I/O
UPPER FAIL	If a current that is greater than or equal to the upper limit is detected, the output is turned off, and an UPPER the output is turned off, and an UPPER FAIL judgment occurs. During the voltage rise time (Rise Time) of DC withstanding voltage tests, an UPPER FAIL judgment also occurs if there is a problem with the voltage rise ratio.	FAIL LED lights OVER is displayed on the screen	ON	Generates a U-FAIL signal
LOWER FAIL	If a current that is less than or equal to the lower limit is detected, the output is turned off, and a LOWER FAIL judgment occurs. This judgment is not performed during voltage rise time (Rise Time) of all tests and during the voltage fall time (Fall Time) of AC withstanding voltage tests.	FAIL LED lights UNDER is displayed on the screen	ON	Generates a L-FAIL signal
PASS	If the specified time elapses without any problems, the output is turned off, and a PASS judgment occurs.	PASS LED lights	ON	Generates a PASS signal

• If PASS HOLD is enabled, the PASS signal is generated continuously until the TOS5300 Series receives a STOP signal.
• The UPPER FAIL and LOWER FAIL signals are generated continuously until the TOS5300 Series receives a STOP signal.
• The FAIL and PASS buzzer volume levels can be changed.
• For PASS judgments, the length of time that the buzzer sounds for is fixed to 0.2 seconds. Even if PASS HOLD is enabled, the buzzer turns off after 0.2 seconds.

*1. Regarding the output time limits:
Taking size, weight, and cost into consideration, the heat dissipation capability of the voltage generator that is used for withstanding voltage tests has been designed to be one half that of the rated output. Use the TOS5300 Series within the following limits. If you use the product in a manner that exceeds these limits, the output section may overheat, and the internal protection circuits may be activated. If this happens, stop testing, and wait until the TOS5300 Series returns to its normal temperature.

Ambient temperature		Upper limit	Pause time	Output time
t ≤ 40 °C	AC	50 mA < i ≤ 110 mA	Greater than or equal to the output time	30 min. max.
		i ≤ 50 mA	Not necessary	Continuous output possible
	DC	5 mA < i ≤ 11 mA	Greater than or equal to the output time	1 min. max.
		i ≤ 5 mA	Greater than or equal to the wait time (WAIT TIME)	Continuous output possible

(Output time = voltage rise time + test time + voltage fall time)

*2. Regarding the test voltage waveform:
Waveform distortions may occur if an DUT whose capacitance is dependent on voltage (for example, an DUT that consists of ceramic capacitors) is connected as the load. However, if the test voltage is 1.5 kV, the effect of a capacitance of 1000 pF or less can be ignored.Because the product's high-voltage power supply uses the PWM switching method, if the test voltage is 500 V or less, the switching and spike noise proportions are large. The lower the test voltage, the greater the waveform is distorted.

*3. Regarding ammeter and judgment accuracy:
During AC withstanding voltage tests, current also flows in the stray capacitance of items such as the measurement leads and jigs. This current that flows in the stray capacitances is added to the current that flows in the DUT, and the sum of these currents is measured.Especially if you want to perform judgments with high sensitivity and accuracy, it is necessary to consider methods to limit the current that flows in these stray capacitances, such as by adding upper and lower limits.

Output voltage	1 kV	2 kV	3 kV	4 kV	5 kV
When using 350 mm long test leads that are suspended in air (TYP)	2 μA	4 μA	6 μA	8 μA	10 μA
When using the accessory, high test lead TL31-TOS (TYP)	16 μA	32 μA	48 μA	64 μA	80 μA

TOS5300 Series Specifications

Insulation resistance test section

			TOS5302
Output section	Output voltage		25 V, 50 V, 100 V, 125 V, 250 V, 500 V, 1000 VDC (negative)
		Accuracy	-0 %, +5 V
	Max. rated load		1 W (-1000 V DC / 1 mA)
	Max. rated current		1 mA
	Ripple	1000 V when no load is connected	2 Vp-p or less
		Max. rated load	10 Vp-p or less
	Voltage regulation		1 % or less (when changing from maximum rated load to no load)
	Short-circuit current		12 mA or less
	Discharge feature		Forced discharge after test completion (discharge resistance: approx. 25 kΩ)
	Limit voltage		The test voltage upper limit can be set : 25 V, 50 V, 100 V, 125 V, 250 V, 500 V, 1000 V
	Output voltage monitor feature		If output voltage exceeds "10 % of set + 10 V" or is lower than "-(10 % of set + 10 V)," output is turned off, and protective features are activated.
Voltmeter	Analog	Scale	6 kV AC/DC f.s
		Accuracy	± 5 % f.s
		Indication	Average value response/rms scale
	Digital	Measurement range	0 V to -1200 V
		Display	Measured voltage: V < 100 V / 100 V ≤ V < 1000 V / 1000 V ≤ V Display: □□ V / □□□ V / □□□□ V
		Accuracy	± (1 % of rdng + 1 V)
Resistance meter	Measurement range / measurement accuracy *4 *5	25 V	0.03 MΩ ≤ R ≤ 25 MΩ / ±(2 % of rdng + 2 digits) 25 MΩ < R ≤ 125 MΩ / ±5 % of rdng 125 MΩ < R ≤ 250 MΩ / ±10 % of rdng
		50 V	0.05 MΩ ≤ R ≤ 50 MΩ / ±(2 % of rdng + 2 digits) 50 MΩ < R ≤ 250 MΩ / ±5 % of rdng 250 MΩ < R ≤ 500 MΩ / ±10 % of rdng
		100 V	0.100 MΩ ≤ R ≤ 100 MΩ / ±2 % of rdng 100 MΩ < R ≤ 500 MΩ / ±5 % of rdng 500 MΩ < R ≤ 1 GΩ / ±10 % of rdng
		125 V	0.125 MΩ ≤ R ≤ 125 MΩ / ±2 % of rdng 125 MΩ < R ≤ 625 MΩ / ±5 % of rdng 625 MΩ < R ≤ 1.25 GΩ / ±10 % of rdng
		250 V	0.250 MΩ ≤ R ≤ 250 MΩ / ±2 % of rdng 250 MΩ < R ≤ 1.25 GΩ / ±5 % of rdng 1.25 GΩ < R ≤ 2.5 GΩ / ±10 % of rdng
		500 V	0.50 MΩ ≤ R ≤ 500 MΩ / ±2 % of rdng 500 MΩ < R ≤ 2.5 GΩ / ±5 % of rdng 2.5 GΩ < R ≤ 5 GΩ / ±10 % of rdng
		1000 V	1 MΩ ≤ R < 1 GΩ / ±2 % of rdng 1 GΩ ≤ R ≤ 5 GΩ / ±5 % of rdng
	Display *5		25 kΩ ≤ R < 1.00 MΩ: □□□ kΩ / 1.00 MΩ ≤ R < 10.0 MΩ: □ . □□ MΩ / 10.0 MΩ ≤ R < 100 MΩ: □□ . □ MΩ / 100.0 MΩ ≤ R < 1.00 GΩ: □□□ MΩ / 1.00 GΩ ≤ R ≤ 9.99 GΩ: □ . □□ GΩ
Hold feature			After a test is finished, the measured resistance is retained until the PASS judgment is cleared.
Current detection response speed			Can be switched between three levels: Fast, Mid, Slow
Judgment feature	Judgment method and judgment operation		See table below
	Upper limit setting range		0.03 MΩ to 5.00 GΩ
	Lower limit setting range		0.03 MΩ to 5.00 GΩ
	Judgment accuracy (the same for UPPER and LOWER)		Measurement accuracy + 2 digits Humidity: 20 %rh to 70 %rh (no condensation). No interference caused by wobbly test leads or other problems. For judgments of 200 nA or less, a test time of at least 1.0 seconds is necessary. If the current detection response speed is set to Mid, a test time of at least 0.3 seconds is necessary. If the current detection response speed is set to Slow, a test time of at least 0.5 seconds is necessary.
Time	Voltage rise time		10 ms (TYP)
	Test Time		0.1 s to 999 s, can be turned off (TIMER OFF)
		Resolution	0.1 s to 99.9 s: 0.1 s. 100 s to 999 s:1 s.
	Accuracy		± (100 ppm + 20 ms)

Judgment	Judgment method	Display	Buzzer	SIGNAL I/O
UPPER FAIL	If a resistance that is greater than or equal to the upper limit is detected, the output is turned off, and an UPPER FAIL judgment occurs. This judgment is not performed during voltage rise time (Rise Time).	FAIL LED lights; OVER is displayed on the screen	ON	Generates a U-FAIL signal
LOWER FAIL	If a resistance that is less than or equal to the lower limit is detected or if a problem occurs during the voltage rise time (Rise Time), the output is turned off, and a LOWER FAIL judgment occurs.	FAIL LED lights; UNDER is displayed on the screen	ON	Generates a L-FAIL signal
PASS	If the specified time elapses without any problems, the output is turned off, and a PASS judgment occurs.	PASS LED lights	ON	Generates a PASS signal

- If PASS HOLD is enabled, the PASS signal is generated continuously until the TOS5300 Series receives a STOP signal.
- The UPPER FAIL and LOWER FAIL signals are generated continuously until the TOS5300 Series receives a STOP signal.
- The FAIL and PASS buzzer volume levels can be changed.
- For PASS judgments, the length of time that the buzzer sounds for is fixed to 0.2 seconds. Even if PASS HOLD is enabled, the buzzer turns off after 0.2 seconds.

*4. Humidity: 20 %rh to 70 %rh (no condensation). No bends in the test leads.
*5. R = measured insulation resistance

TOS5300 Series Specifications

Other features/Interfaces

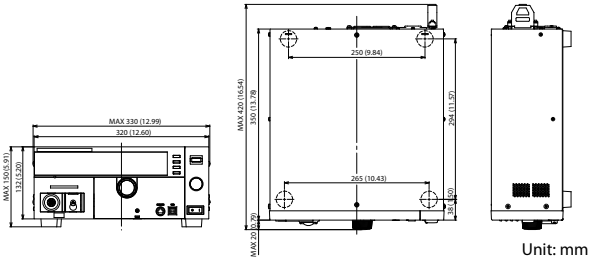
Model		TOS5300	TOS5301	TOS5302
Double action feature		Tests can only be started by pressing and releasing STOP and then pressing START within 0.5 seconds of releasing the STOP switch.		
Length of time to maintain a PASS judgment result		You can set the length of time to maintain a PASS judgment: 50 ms, 100 ms, 200 ms, 1 s, 2 s,5 s, or HOLD.		
Momentary feature		Tests are only executed while the START switch is held down.		
Fail mode feature		This feature enables you to prevent remotely transmitted stop signals from clearing FAIL judgments and PROTECTION modes.		
Timer feature		This feature finishes tests when the specified time elapses.		
Output voltage monitor feature		If output voltage exceeds “setting + 350 V” or is lower than “setting - 350 V,” the TOS5300 Series switches to PROTECTION mode, output is turned off, and testing finishes.		
Memory		Up to three sets of test conditions can be saved to memory.		
Key lock		Locks panel key operations (settings and changes).		
Protective features		Under any of the following conditions, the TOS5300 Series switches to the PROTECTION state, immediately turns output off, and stops testing. A message is displayed on the screen.		
	Interlock Protection	An interlock signal has been detected.		
	Power Supply Protection	An error was detected in the power supply.		
	Volt Error Protection	While monitoring the output voltage, a voltage outside of the rated limits was detected. AC or DC withstanding voltage tests: ±350 V Insulation resistance test: ±(10 % of set + 10 V)		
	Over Load Protection	During a withstanding voltage test, a value that is greater than or equal to the output limit power was specified. AC withstanding voltage test: 550 VA. DC withstanding voltage test: 55 VA.		
	Over Heat Protection	The internal temperature of the TOS5300 Series became too high.		
	Over Rating Protection	During a withstanding voltage test, the output current was generated for a length of time that exceeds the regulated time.		
	Calibration Protection	The specified calibration period has elapsed.		
	Remote Protection	A connection to or disconnection from the front-panel REMOTE connector was detected.		
	SIGNAL I/O Protection	The rear-panel SIGNAL I/O connector’s ENABLE signal has changed.		
	USB Protection	The USB connector has been disconnected while the TOS5300 Series was being controlled through the USB interface.		
System clock		Set in the following format: year/month/day hour/minutes/seconds.		
	Calibration date	Set when the TOS5300 Series is calibrated.		
	Calibration period setting	Sets the period before the next calibration is necessary.		
	Notification of when the calibration period elapses	Sets the operation that is performed when the specified calibration period elapses. When the TOS5300 Series turns on, it can display a notification or switch to the protection mode and disable testing.		
Interfaces	USB	USB Specification 2.0		
	REMOTE	Front-panel 9-pin MINI DIN connector. By connecting an optional device to this connector, you can control the starting and stopping of tests remotely.		
	SIGNAL I/O	Rear-panel D-sub 25-pin connector		

General

Model			TOS5300	TOS5301	TOS5302
Display			VFD: 256 × 64 dots + 4 status indicators		
Backup battery life			3 years (at 25 °C or 77 °F)		
Environment	Installation location		Indoors, at a height of up to 2000 m		
	Spec guaranteed range	Temperature	5 °C to 35 °C (41 °F to 95 °F)		
		Humidity	20 %rh to 80 %rh (no condensation)		
	Operating range	Temperature	0 °C to 40 °C (32 °F to 104 °F)		
		Humidity	20 %rh to 80 %rh (no condensation)		
	Storage range	Temperature	-20 °C to 70 °C (-4 °F to 158 °F)		
		Humidity	90 %rh or less (no condensation)		
Power supply	Nominal voltage range (allowable voltage range)		100 VAC to 240 VAC (90 VAC to 250 VAC)		
	Power consumptio	When no load is connected (READY)	100 VA or less		
		When rated load isconnected	800 VA max.		
	Allowable frequency range		47 Hz to 63 Hz		
Insulation resistance (between AC LINE and the chassis)			30 MΩ or more (500 VDC)		
Withstanding voltage (between AC LINE and the chassis)			1390 VAC, 2 seconds, 20 mA or less		
Earth continuity			25 AAC, 0.1 Ω or less		
Safety *6			Complies with the requirements of the following directive and standard. Low Voltage Directive 2006/95/EC, EN 61010-1 Class I Pollution degree 2		
Electromagnetic compatibility (EMC) *6 *7			Complies with the requirements of the following directive and standard. EMC Directive 2004/108/EC, EN 61326-1, EN 61000-3-2, EN 61000-3-3 Applicable under the following conditions The maximum length of all cabling and wiring connected to the TOS5300 Series must be less than 3 m. The high test lead TL31-TOS is being used. Electrical discharges are not occurring outside the DUT.		
Dimensions			See “Outline drawing.”		
Weight			Approx. 14 kg (30.9 lb.)	Approx. 15 kg (33.1 lb.)	Approx. 14 kg (30.9 lb.)
Accessories			Power cord: 1pc./High test lead (TL31-TOS): 1set (1 red wire and 1 black wire, each with alligator clips); 1.5 m/ D-sub 25-pin plug: 1set ; assembly type/High-voltage warning sticker: 1pc./User’s manual: 1pc. / CD-R: 1pc. *8		

*6. Does not apply to specially ordered or modified TOS5300 Series testers.
*7. Limited to products that have the CE mark on their panels.
*8. Contains the User’s Manual, the Communication Interface Manual, the KI-VISA library, and the Safety evalution test.

External Dimensional Diagrams



Unit: mm (inch)

Hipot Tester (AC)

TOS5050A

RS-232C CE

Dimensions / Weight

320(12.6″)W × 132(5.2″)H × 300(11.81″)Dmm / 18kg(39.68 lbs)

Accessories

High-voltage test lead: TL01-TOS (max.allowablevoltage: 5 kV/1.5 m)

Capable to record and storage of the test data

TOS5000A Series are exclusively designed for the hipot test which comply to the various safety standards.
The model TOS5050A is the basic type in compliance with general standard testing and High cost performance.

Features

- Complies with various safety standards
- AC output
- Large color display
- Digital voltmeter and ammeter
- Digital timer
- Window comparator type employed for PASS/FAIL judgement.
- Equipped with remote control function
- Various signal outputs
- Provided with zero turn-on switch
- Equipped with RS-232C as standard

Hipot Tester (AC/DC)

TOS5051A

RS-232C CE

Dimensions / Weight

320(12.6″)W × 132(5.2″)H × 300(11.81″)Dmm / 19kg(41.89 lbs)

Accessories

High-voltage test lead: TL01-TOS (max.allowablevoltage: 5 kV/1.5 m)

Capable to record and storage of the test data AC/DC Output 5 kV type

TOS5000A Series are exclusively designed for the hipot test which comply to the various safety standards.
The model TOS5051A is the type having with 5 kV output in both AC and DC.

Features

- Complies with various safety standards
- AC/DC output
- Large color display
- Digital voltmeter and ammeter
- Digital timer
- Window comparator type employed for PASS/FAIL judgement.
- Equipped with remote control function
- Various signal outputs
- Automatic discharge function (during DC operation)
- Provided with zero turn-on switch
- Equipped with RS-232C as standard

Data Acquisition for TOS5051A/5050A

SD004-TOS5000A

Operating Environment

Pentium III or later, Windows XP/Windows 2000/Windows Me, Windows 7, CD-ROM drive, mouse, display supporting 800 x 600 resolution, 128 MB or more of memory (recommended), 50 MB or more of free space in hard disk drive (for installation) plus sufficient disk capacity to store necessary files, and RS-232C [data rate of 9600 bps; use an RS-232C null-modem cable (cross-over cable) for connection.]

Providing an Easy Way to Collect, Manage, and Save Test Results

Highly Reliable Quality Control Can Be Achieved!

SD004-TOS5000A is a software product that lets you collect and manage test results generated by our TOS5000A Series Hipot testers. Also, SD004-TOS5000A allows you to save, search, and print data with ease. What's more, you can execute or stop the test through a simple operation using a PC.

Features

- Test mode: Execution/stop function and automatic serial number incrementing function
- Search mode: Data item rearrangement and ascending/descending order function, search function (ambiguity search supported), print function (layout change supported), and text and HTML file output function.

TOS5050A/TOS5051A Specifications

Item		TOS5050A	TOS5051A
Output block			
Applied Voltage		0 to 2.5/ 0 to 5 kV AC	0 to 2.5/ 0 to 5 kV AC and DC
AC			
Output Rating (with nominal line voltage)		500 VA/5 kV, 100 mA	
Waveform		Commercial line waveform	
Voltage Regulation (with nominal line voltage)		Max. 15 % (for max. rated load to no load)	
Switching		Use of a zero turn-on switch	
DC			
Maximum Output Rating (with nominal line voltage)		—	50 W/5 kV, 10 mA
Ripple		—	100 Vp-p typ. at 5 kV, no load 100 Vp-p typ. at max. rated output
Voltage Regulation (with nominal line voltage)		—	3 % or better (against change from maximum rated load to no load)
Output Voltmeters			
Analog	Scale	5 kV full scale (no mirrors), AC	5 kV full scale (no mirrors), AC/DC
	Class	JIS Class 2.5	
	Accuracy	±5 % of full scale	
	AC Indication	Mean value response/rms value scale	
Digital	Full Scale	2.5 kV/ 5kV full scale	
	Accuracy	±1.5 % of full scale	
	AC Response	Mean value response/rms value display	
Ammeter			
Digital	Accuracy	±(5 % + 20 μA) of upper cutoff current	
	AC Response	Mean value response/rms value display	
Pass/fail Judgement Function			
Type of Judgement		• Window comparator type • If the current detected is larger than the preset upper cutoff current, the tester gives a FAIL judgement. • If the current detected is less than the preset lower cutoff current, the tester gives a FAIL judgement. • As the tester gives a FAIL judgement, it cuts off the output and delivers a FAIL signal. • If the test period elapses without any unacceptable conditions, the tester gives a PASS judgement	
Upper cutoff current setting range		AC: 0.1 to 110 mA	AC: 0.1 to 110 mA DC: 0.1 to 11 mA
Lower cutoff current setting range		AC: 0.1 to 110 mA	AC: 0.1 to 110 mA DC: 0.1 to 11 mA
Judgement Accuracy		±(5% of upper cutoff current + 20μA)	
Current Detection		The absolute value of current is integrated and compared with the preset cutoff current value.	
Calibration		Calibrated for rms value of sine wave, with pure-resistive load	
No-load output voltage required for detection		Approx. 460 V when set to 100 mA AC	
		—	Approx. 100 V when set to 10 mA DC
Test Time Setting Range		0.5 to 999 sec (±10 ms) (timer-off function provided)	
Accuracy		±20 ms	
Line Voltage		100V±10%, 50/60 Hz (Nominal voltages of 110V, 120V, 220V, 230V and 240V available as factory options.)	
RS-232C			
Connector		D-SUB 9-pin connector on the rear panel (conforms to EIA-232-D)Outputs test data and test results	
Protocol		9600 bps, 8 bits Data Length, None-Parity, Stop bit 1 bit	
Function		Query test result, status and measured value, and start and stop test (Incapable of setting test condition)	
Power Requirements			
for line voltage of 220 V to 240 V		Max. 25 VA under no-load conditions/Approx. 640 VA at rated load	Max. 50 VA under no-load conditions/Approx. 640 VA at rated load
Electromagnetic compatibility (EMC) *1		Conforms to the requirements of the following directive and standard.EMC Directive 2004/108/EC, EN61326, EN61000-3-2, EN61000-3-3 Under following conditions 1. Used HV test leadwires which is supplied. 2. No discharge in testing. 3. Used the shielded cable which length is less than three meters when the SIGNAL I/O is used.	
Safty *1 *2		Low Voltage Directive 2006/95/EC,EN61010-1, Class I , Pollution degree 2	
Environment		Ambient temperature and humidity: 5 °C to 35 °C/20 %rh to 80 %rh	
		Operable temperature and humidity: 0 °C to 40 °C/20 %rh to 80 %rh	
		Storage temperature and humidity: -20 °C to 70 °C/80 %rh or less	
Dimensions (MAX)		320(330)W× 132(150)H × 300(365)Dmm	
Weight			
for line voltage of 220 V to 240 V		Approx. 18 kg	Approx. 19 kg
Accessories			
High-voltage test lead		TL01-TOS (max.allowablevoltage: 5 kV/1.5 m)	
Others		14-pin amphenol plug (assembled)	

*1 Only on models that have CE marking on the panel. Not applicable to custom order models.

*2 Not applicable to custom order models.

Insulation Resistance Tester

TOS7200

RS-232C CE

Dimensions / Weight

215(8.47″)W × 66(2.6″)H × 230(9.06″)Dmm / 2kg(4.41 lbs)

Accessories

AC power cable, TL08-TOS high-voltage test leadwires (1.5 m), Operation Manual

Complied with the test voltage -25 V to -1000 Vdc of the JIS C 1302-2002

The TOS7200 is an insulation resistance tester available for a wide range of various electric and electronic components, as well as electric and electronic equipment. The output voltage can be set at desired value in the range of -25 V to -1,000 V with a resolution of 1 V. (conforms with the output characteristics of the JIS C 1302-2002). As it is fitted with a window comparator and timer function, the tester is capable of efficiently conducting insulation resistance tests based on various safety standards. In addition, this product is equipped with panel memory as standard feature, which can be recalled by remote control, SIGNAL I/O connector, and the RS-232C interface for easy automatic testing system construction.

Features

- Output voltage range: -25 V to -1000 Vdc (conforms with the output characteristics of the JIS C 1302-2002)
- Resistance measurement range: 0.01 MΩ to 5000 MΩ
- Provided with the discharge function
- Equipped with the window comparator
- Hold function (which holds the measured resistance at the end of testing while PASS judgment is being output)
- Provided with the timer function
- Rear output terminals
- Measured-value monitoring terminals
- Equipped with the panel memory (enabling 10 different settings to be stored)
- Equipped with the SIGNAL I/O connector and remote control terminal
- Equipped with RS-232C interface as standard

TOS7200 Specifications

Output section		
Output voltage range		-25 V to -1000 V
	Resolution	1 V
	Accuracy	±(1.5 % of setting + 2 V)
Maximum rated load		1 W (-1000 V DC/1 mA)
Maximum rated current		1 mA
Output terminals	Output type	Floating
	Isolation voltage	±1000 VDC
Ripple	1000 V/under no load	2 Vp-p or less
	Maximum rated load	10 Vp-p or less
Short-circuiting current		12 mA or less
Output rise time		50 ms or less (10 % to 90 %) [no load]
Discharge function		Forced discharge at the end of test (discharge resistance: 25 k Ω)
Voltmeter		
Measurement range		0 V to -1200 V
Resolution		1 V
Accuracy		±(1 % of reading +1 V)
Resistance meter		
Measurement range		0.01 M Ω to 5000 M Ω (In the range of over 100 nA to a maximum rated current of 1 mA)
Display		R < 10.0 MΩ: □.□□ MΩ 10.0 MΩ ≤ R < 100.0 MΩ: □□.□ MΩ 100.0 MΩ ≤ R < 1000 MΩ: □□□ MΩ 1000 MΩ ≤ R ≤ 5000 MΩ: □□□□ MΩ R = measured insulation resistance
Accuracy		100 nA < i ≤ 200 nA: ± (10 % of reading) 200 nA < i ≤ 1 µA: ± (5 % of reading) 1 µA < i ≤ 1 mA: ± (2 % of reading) i =measured output-voltage value/measured resistance value [In the humidity range of 20 %rh to 70 %rh (no condensation), with no disturbance such as swinging of the test leadwire]
Measurement range		The current measurement range is selectable between AUTO and FIX.
	AUTO	Automatically changes the current measurement range according to the measured current value.
	FIX	Fixes the current measurement range based on the output voltage set value and LOWER set value (in UPPER OFF status).
Holding function		Holds the resistance value obtained at the end of testing while a PASS judgment is being output.

Judgment function

Judgement method/action

Judgement	Judgement method	Display	Buzzer	SIGNAL I/O
UPPER FAIL	If a resistance value equal or higher than the upper resistance is detected, the tester shuts off the output and returns an UPPER FAIL judgment.	FAIL LED lights. UPPER LED lights.	ON	Outputs an U FAIL signal
LOWER FAIL	If a resistance value equal or less than the lower resistance is detected, the tester shuts off the output and returns a LOWER FAIL judgment. Note that no judgment is made within the judgment wait time (WAIT TIME) after the start of the test.	FAIL LED lights. LOWER LED lights.	ON	Outputs a L FAIL signal
PASS	If no abnormality is found when the set test time has elapsed, the tester shuts off the output and returns a PASS judgment.	PASS LED lights.	ON	Outputs a PASS signal

- A PASS signal is output for approx. 200 ms. However, if the PASS HOLD function is set to “HOLD,” the signal is continuously output until a STOP signal is input.
- An UPPER FAIL or LOWER FAIL signal is continuously output until a STOP signal is input.
- The FAIL and PASS buzzer volumes are adjustable. However, they cannot be adjusted individually, as they are set in common.

Setting range for the upper resistance (UPPER)	0.01 M Ω to 5000 M Ω [In the range of the maximum rated current or less]
Setting range for the lower resistance (LOWER)	0.01 M Ω to 5000 M Ω [In the range of the maximum rated current or less]

Judgement accuracy
For both UPPER and LOWER

Judgement current		100 nA < i ≤ 200 nA	200nA < i ≤ 1 µA	1 µA < i ≤ 1 mA
UPPER, LOWER	0.01 ≤ R < 10.0 MΩ	—	—	± (2 % of setting + 3digit)
	10.0 ≤ R < 50.0 M5Ω	—	± (5 % of setting + 5digit)	± (2 % of setting + 3digit)
	50.0 ≤ R < 100 MΩ	—	± (5 % of setting + 5digit)	± (2 % of setting + 3digit)
	100 MΩ ≤ R < 200 MΩ	± (10 % of setting + 5digit)	± (5 % of setting + 5digit)	± (2 % of setting + 3digit)
	200 MΩ ≤ R < 500 MΩ	± (10 % of setting + 5digit)	± (5 % of setting + 5digit)	± (2 % of setting + 3digit)
	500 MΩ ≤ R < 1000 MΩ	± (10 % of setting + 5digit)	± (5 % of setting + 5digit)	± (2 % of setting + 3digit)
	1000 MΩ ≤ R < 2000 MΩ	± (10 % of setting + 50digit)	± (5 % of setting + 50digit)	—
	2000 MΩ ≤ R < 5000 MΩ	± (10 % of setting + 100digit)	± (5 % of setting + 50digit)	—

Judgement current = test voltage/(UPPER,LOWER)

[The humidity must be in the range of 20 %rh to 70 %rh (no condensation permitted), and there must be no disturbance such as swinging of the test leadwires.]
[The lower judgment requires a test duration of 0.5 s or more after the wait time has expired. It also requires a wait time of 1.0 s or more for a lower judgment of 200 nA or less.]

Time	
Setting range for the test duration (TEST TIME)	0.5 s to 999 s (TIMER OFF function provided)
Setting range for the wait time (WAIT TIME)	0.3 s to 10 s [TEST TIME > WAIT TIME]
Accuracy	±(100 ppm + 20 ms)

TOS7200 Specifications

Interface and Other Functions

REMOTE	6-pin mini-DIN connector on the front panel The optional remote controller RC01-TOS or RC02-TOS is connected to remotely control starting/stopping of a test (note that a DIN-mini DIN adapter is required).
SIGNAL I/O	D-SUB 25-pin connector on the rear panel For names and descriptions of connector signals.

No.	Signal name	I/O	Description of signal
1	PM0	I	LSB *1
2	PM1	I	*1
3	PM2	I	*1
4	PM3	I	MSB *1
5	N.C		
6	N.C		
7	N.C		
8	N.C		
9	STB	I	Input terminal for the strobe signal of the panel memory
10	N.C		
11	N.C		
12	N.C		
13	COM		Circuit common (chassis potential)
14	HV ON	O	ON during a test or while a voltage remains between the output terminals
15	TEST	O	ON during a test
16	PASS	O	ON for approx. 0.2 seconds when PASS judgment is made, or continuously ON while PASS HOLD is activated
17	U FAIL	O	Continuously ON if an insulation resistance equal to or exceed-ing the upper resistance is detected, resulting in FAIL judgment
18	L FAIL	O	Continuously ON if an insulation resistance equal to or falling below the lower resistance is detected, resulting in FAIL judg-ment
19	READY	O	ON during standby
20	N.C		
21	START	I	Input terminal for the START signal
22	STOP	I	Input terminal for the STOP signal
23	ENABLE	I	Remote control enable signal input terminal
24	N.C		
25	COM		Circuit common (chassis potential)

*1 1-digit BCD active LOW input
Panel memory's selection signal input terminal
Memory recall by latching this selection signal at the rise of the strobe signal

Input specifications			
	High-level input voltage	11 V to 15 V	All input signals are active Low controlled. The input terminal is pulled up to +12 V using a resistor. Opening the input terminal is equivalent to inputting a high-level signal.
	Low-level input voltage	0 V to 4 V	
	Low-level input current	-5 mA maximum	
	Input time width	5 ms minimum	
Output specifications			
	Output method	Open collector output (4.5 V to 30 V DC)	
	Output withstand voltage	30 V DC	
	Output saturation voltage	Approx. 1.1 V (at 25 °C)	
	Maximum output current	400 mA (TOTAL)	
ANALOG OUT		Outputs a logarithmically compressed voltage corresponding to the measured resistance value	
	+	Vo = log (1 + Rx/1MΩ) where Rx = measured resistance value (1 MΩ: 0.30 V; 10 MΩ: 1.04 V; 100 MΩ: 2.00 V; 1000 MΩ: 3.00 V; 10000 MΩ or more: 4.00 V). Output impedance: 1 kΩ	
	COM	Analog output-circuit common	
	Accuracy	±(2 % of full scale)	
RS-232C		D-SUB 9-pin connector on the rear panel (compliant with EIA-232-D) All functions other than the POWER switch and KEY-LOCK function are remotely controllable.	
	Baud rate	9600 bps/19200 bps/38400 bps (data: 8 bits; parity: none; stop bit: 2 bits fixed)	
Display		7-segment LED, 4-digit voltage display, 4-digit insulation resistance display, and 3-digit time display	
Memory function		A maximum of 10 types of test conditions can be stored in memory.	
Backup battery life		3 years or more (at 25 °C)	
TEST MODE			
	MOMENTARY	A test is conducted only when the START switch is pressed.	
	FAIL MODE	Disables cancellation of FAIL judgment using a stop signal via remote control.	
	DOUBLE ACTION	Starts a test only when the STOP switch is pressed and the START switch is pressed within approximately a half-second.	
	PASS HOLD	Allows the time of holding PASS judgment to be set to 0.2 s or HOLD.	
KEYLOCK		Places the tester in a state in which no keystroke other than the START/STOP switch is accepted.	

General Specifications

Environment	
Installation location	Indoors and at altitudes up to 2000 m
Warranty range	Temperature 5 °C to 35 °C
	Humidity 20 %rh to 80 %rh (no condensation)
Operating range	Temperature 0 °C to 40 °C
	Humidity 20 %rh to 80 %rh (no condensation)
Storage range	Temperature -20 °C to 70 °C
	Humidity 90 %rh or less (no condensation)
Power requirements	
Nominal voltage range (allowable voltage range)	100 V to 240 V AC (85 V to 250 V AC)
Power consumption At rated load	30 VA maximum
Allowable frequency range	47 Hz to 63 Hz
Insulation resistance	30 MΩ or more (500 V DC) [AC LINE to chassis]
Hipot	1390 V AC for 2 seconds, 10 mA or less [AC LINE to chassis]
Ground bond	25 A AC/0.1 Ω or less

Electromagnetic compatibility (EMC) *1

Conforms to the requirements of the following directive and standard.
EMC Directive 2004/108/EC
EN61326
EN61000-3-2
EN61000-3-3
Under following conditions
1. Used HV test leadwires TL08-TOS which is supplied.
2. No discharge occurs at outside of the tester.
3. Used the shielded cable which length is less than three meters when the SIGNAL I/O is used.

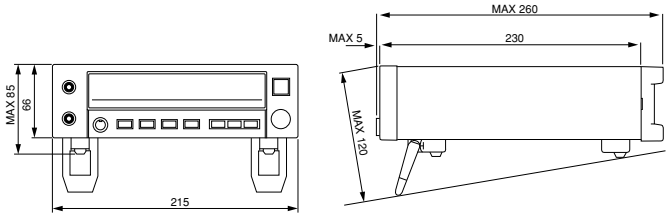
Safety *1 *2

Conforms to the requirements of the following directive and standard.
Low Voltage Directive 2006/95/EC
EN61010-1
Class I
Pollution degree 2

Dimensions (max.)	215 (215) W x 66 (85) H x 230 (260) Dmm
Weight	Approx. 2 kg
Accessories	AC power cable 1 pc. TL08-TOS high-voltage test leadwires (1.5 m) 1 set Operation Manual 1 copy

*1 Only on models that have CE marking on the panel. Not applicable to custom order models.
*2 This instrument is a Class I equipment. Be sure to ground the protective conductor terminal of the instrument. The safety of the instrument is not guaranteed unless the instrument is grounded properly.

External Dimensional Diagrams



Unit: mm

Ground Bond Tester

TOS6210

GPIB RS-232C DRIVERS CE

Dimensions / Weight

430(16.93″)W × 88(3.47″)H × 270(10.63″)Dmm / 11kg(24.25 lbs)

Accessories

AC power cord, Test leadwire TL12-TOS, Short bar(2pcs., these are inserted between the OUTPUT and SAMPLING terminals.), AC power fuse(2pcs., including one spare in the fuse holder), Operation manual

Supports UL60950-1 - New Standard for Information Technology Equipment (ITE)

While inheriting the basic performance and functions of its predecessor (TOS6200), such as a constant current driving system that provides current waveforms with little skew and high measurement accuracy, the TOS6210 tester extends the maximum test current from 30 A to 60 A, which is demanded by the new standard. In addition, the tester also lets you judge the acceptability of the device under test based on the drop in voltage, as required in the standard. What's more, you can preset test conditions of up to 20 different types of safety standards, such as those for information technology equipment, home appliances, medical devices, and measuring instruments, in the memory on the main unit's panel. A simple memory call operation allows you to set up a protective earthling or protective bonding continuity test as stipulated in UL60950-1 and other relevant specifications including IEC and JIS standards. The tester also features a set of functions that meet the specific needs of testing personnel, such as an offset cancellation function and a memo function that allows you to input calibration dates, production numbers, and other test-related information and read the input information later via the GPIB or RS-232C interface.

Features

- Test current value: 6 A to 62 A AC / Resistance value: 0.001Ω to 0.600Ω
- Voltage judgement function
- Offset cancelling function
- Stores 100 test conditions in memory
- Incorporates test conditions into program
- Contact Check function
- Equipped with standard GPIB and RS-232C interfaces
- Equipped with standard test lead (TL12-TOS)

Ground Bond Tester

TOS6200

GPIB RS-232C DRIVERS CE

Dimensions / Weight

430(16.93″)W × 88(3.47″)H × 270(10.63″)Dmm / 9kg(19.84 lbs)

Accessories

AC power cord, Test leadwire TL11-TOS, Short bar(2pcs., these are inserted between the OUTPUT and SAMPLING terminals.), AC power fuse(2pcs., including one spare in the fuse holder), Operation manual

Pursuing to maximize an easy operation, stylish design of Ground Bond Tester

The TOS6200 tester is designed to perform the ground bond tests required for class-I devices by safety standards such as IEC, EN, VDE, BS, UL, JIS, and the Electrical Appliance and Material Safety Low (Japan). Equipped with a new high-efficiency power supply, it is compact and lightweight, about half the size and weight of our conventional products, while achieving a large output of 150 VA. Use of the constant current method eliminates the need to reset test currents even in the face of fluctuating resistance values for the device being tested. The test duration can also be set from 0.3 s, making the tester suitable for production line testing, which requires reduced cycle time. This tester is also designed for ease of use, featuring a large, easy-to-read display, memory capacity for storage of 100 types of test conditions, and incorporation of test conditions into programs to enable automatic testing. Standard GPIB and RS-232C interfaces allow the user to use PCs or other devices to control test conditions such as test current, resistance value for judgement, and test duration, and enables read-back of measured values and test results.

Features

- Test current value: 3 A to 30 A AC / Resistance value: 0.001 Ω to 1.200 Ω
- Offset cancelling function
- Stores 100 test conditions in memory
- Incorporates test conditions into program
- Contact Check function
- Equipped with standard GPIB and RS-232C interfaces
- Equipped with standard test lead (TL11-TOS)

TOS6210 Specifications

Output block		
Current setting range *1		6.0 to 62.0 A AC (With respect to resistance resulting in output power of the maximum rated Output or less and an output terminal voltage of 5.4 V or less)
	Resolution	0.1 A
	Accuracy	± (1 % of setting + 0.4 A)
Maximum rated output		220 VA (at the output terminals)
Distortion factor		2% or less (with respect to 0.1 Ω pure resistance load of 20 A or greater)
Frequency		50/60 Hz, sine wave (selectable)
	Accuracy	±200 ppm
Open terminal voltage		6 Vrms or less
Output method		PWM switching method
Output ammeter		
Measurement range		0.0 to 66.0 A AC
Resolution		0.1 A
Accuracy		± (1 % of reading + 0.4 A)
Response		Mean value response/rms value display (response time: 200 ms)
Holding function		The current measured at the end of test is held during the PASS or FAIL inteval
Output voltmeter		
Measurement range		0.00 to 6.00 V AC
Resolution		0.01 V
Offset cancel function		0.00 to 5.40 V (Offset ON/OFF function provided)
Accuracy		± (1 % of reading + 0.02 V)
Response		Mean value response/rms value display (response time: 200 ms)
Holding function		The voltage measured at the end of test is held during the PASS or FAIL inteval
Ohmmeter *2		
Measurement range		0.001 to 0.600 Ω
Resolution		0.001 Ω
Offset cancel function		0.000 to 0.600 Ω (Offset ON/OFF function provided)
Accuracy		± (2 % of reading + 0.003 Ω)
Holding function		The resistance measured at the end of test is held during the PASS or FAIL interval
Pass/fail judgement function *3		
Resistance value-based judgement		Window comparator system •If a resistance value equal to or greater than the upper reference value is detected, a FAIL determination is returned. •If a resistance value equal to or less than the lower reference value is detected, a FAIL determination is returned. •If a resistance value has been judged as FAIL, the tester shuts off the output and generates a FAIL signal .•If the set time elapses without abnormalities, the tester shuts off the output and generates a PASS signal.
	Setting range for the upper reference value (UPPER)	0.001 to 0.600 Ω
	Setting range for the lower reference value (LOWER)	0.001 to 0.600 Ω
	Resolution	0.001 Ω
	Judgement accuracy	± (2 % of UPPER + 0.003 Ω)
Sampled voltage value-based judgement		Window comparator system •If a voltage value equal to or greater than the upper reference value is detected, a FAIL determination is returned. •If a voltage value equal to or less than the lower reference value is detected, a FAIL determination is returned. •If a voltage value has been judged as FAIL, the tester shuts off the output and generates a FAIL signal. •If the set time elapses without abnormalities, the tester shuts off the output and generates a PASS signal.
	Setting range for the upper reference value (UPPER) *4	0.01 to 5.40 V
	Setting range for the lower reference value (LOWER)	0.01 to 5.40 V
	Resolution	0.01 V
	Judgement accuracy	± (2 % of UPPER + 0.05 V)
Calibration		Calibration is performed with the rms value of the sine wave, using a pure resistance load.
LED	PASS	Lights for approximately 0.2 sec when the measured value has been judged as PASS. It is lit continuously when the PASS holding time is set to HOLD.
	UPPER FAIL	Lights if a resistance or voltage value equal to or greater than the upper reference value is detected and judged FAIL.
	LOWER FAIL	Lights if a resistance or voltage value equal to or greater than the upper reference value is detected and judged FAIL.
Buzzer		•The buzzer sounds for the pass holding time has been set if the measured value has been judged as PASS. •The buzzer sounds continuously under the following condition: The measured value has been judged as PASS when the PASS holding time is set to HOLD. The measured value has been judged as UPPER FAIL. The measured value has been judged as LOWER FAIL. •The buzzer volume for FAIL or PASS judgment are adjustable. Note that it cannot be adjusted individually since setting is shared with the setting for PASS.

*1 Time limitation with respect to output
The heat radiation capacity at the output block of the tester is designed to be onethird of the rated output, accounting for size, weight, cost, and other factors. Always use the tester within the limitation values given below. Use of the tester beyond these limits will cause the temperature of the output block to rise excessively, potentially tripping the internal protection circuit. In this case, suspend testing for approximately 30 minutes, then press the STOP switch. When temperatures fall to normal levels, the tester will revert to ready status.

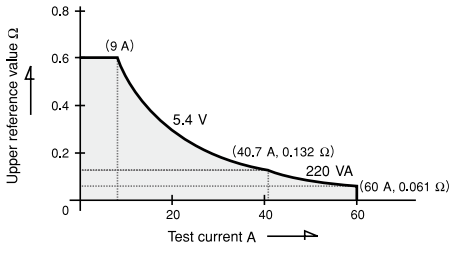
Output time limitation			
Ambient temperature t (°C)	Test current I (A)	Pause time	Maximum allowable continuous test time
t ≤ 40 °	40 < I ≤ 60	Equal to or greater than the test time	≤ 10 minutes
	20 < I ≤ 40	Equal to or greater than the test time	≤ 30 minutes
	I ≤ 20	Not required	Continuous output possible

*2 About ohmmeter's response time
A resistance value is instantaneously obtained, calculated using the measured voltage and current values. The response time of the ohmmeter complies with the response times of the voltmeter and ammeter.

*3 Resistance value-based and sampled voltage value-based judgments cannot be simultaneously conducted.

*4 Limited by the maximum rated output and the output terminal voltage. The tester can be used within the range shown below.

Allowable range in which to determine the test current value and upper reference value



TOS6210 Specifications

Time		
Test time	Setting range	Setting range 0.3 to 999 s Timer ON/OFF function is available.
	Accuracy	± (100 ppm of setting + 20 ms)
Environment		
Operating environment		Indoor use, Overvoltage Category II
Warranty range	Temperature	5 ° to 35 °C
	Humidity	20 %rh to 80 %rh (non condensing)
Operating range	Temperature	0 ° to 40 °C
	Humidity	20 %rh to 80 %rh (non condensing)
Storage range	Temperature	-20 ° to 70 °C
	Humidity	90 %rh or less (non condensing)
Altitude		Up to 2000 m
Power requirement		
Allowable voltage range		85 to 250 V AC
Power consumption	At no load (READY)	60 VA or less
	At rated load	420 VA max.
Allowable frequency range		47 Hz to 63 Hz
Insulation resistance		30 MΩ min. (500 V DC), between AC line and chassis
Hipot		1390 V AC (2 seconds), between AC line and chassis
Ground bond		25 A AC/0.1 Ω max.
Electromagnetic compatibility (EMC) *5 *6		

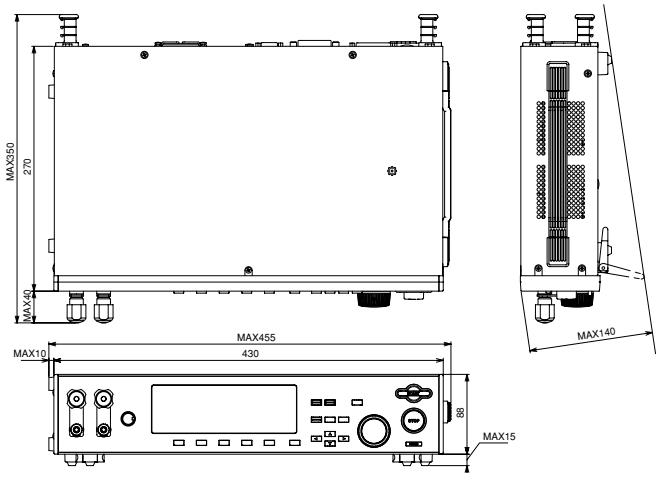
Conforms to the requirements of the following directive and standard.
EMC Directive 2004/108/EC
EN61326
EN61000-3-2
EN61000-3-3
Under following conditions
1. Used test leadwire (TL12-TOS) which is supplied.
2. Used the shielded cable which length is less than three meters when the SIGNAL I/O is used.

Safety *5	
Conforms to the requirements of the following directive and standard. Low Voltage Directive 2006/95/EC EN61010-1 Class I Pollution degree 2	
Physical dimensions (max)	430(455) W × 88(140) H × 270(350)D mm
Weight	Approx. 11 kg
Accessories	
AC power cord	1 piece
Test leadwire TL12-TOS	1 set
Short bar	2 pieces (These are inserted between the OUTPUT and SAMPLING terminals.)
AC power fuse	2 pieces (2, including one spare in the fuse holder)
Operation manual	1 copy

*5 Not applicable to custom order models.

*6 Only on models that have CE marking on the panel.

External Dimensional Diagrams



Unit: mm

TOS6200 Specifications

Output block		
Current setting range *1		3.0 to 30.0 A AC (With respect to resistance resulting in output power of the maximum rated Output or less and an output terminal voltage of 5.4 V or less)
	Resolution	0.1 A
	Accuracy	± (1% of setting + 0.2A)
Maximum rated output		150 VA (at the output terminals)
Distortion factor		2 % or less (with respect to 0.1 Ω pure resistance load of 10 A or greater)
Frequency		50/60 Hz, sine wave (selectable)
	Accuracy	±200 ppm
Open terminal voltage		6 Vrms or less
Output method		PWM switching method
Output ammeter		
Measurement range		0.0 to 33.0 A AC
Resolution		0.1 A
Accuracy		± (1 % of reading + 0.2 A)
Response		Mean value response/rms value display (response time: 200 ms)
Holding function		The current measured at the end of test is held during the PASS or FAIL inteval
Output voltmeter		
Measurement range		0.00 to 6.00 V AC
Resolution		0.01 V
Accuracy		± (1 % of reading + 0.02 V)
Response		Mean value response/rms value display (response time: 200 ms)
Holding function		The voltage measured at the end of test is held during the PASS or FAIL inteval
Ohmmeter *2		
Measurement range		0.001 to 1.200 Ω
Resolution		0.001 Ω
Offset cancel function		0.000 to 1.200 Ω (Offset ON/OFF function provided)
Accuracy		± (2 % of reading + 0.003 Ω)
Holding function		The resistance measured at the end of test is held during the PASS interval
Pass/fail judgement function		
Resistance value-based judgement		Window comparator system •If a resistance value equal to or greater than the upper reference value is detected,a FAILdetermination is returned. •If a resistance value equal to or less than the lower reference value is detected, a FAIL determination is returned. •If a resistance value has been judged as FAIL, the tester shuts off the output and generates a FAIL signal. •If the set time elapses without abnormalities, the tester shuts off the output and generates a PASS signal.
Setting range for the upper rerence value (UPPER)		0.001 to 1.200 Ω
Setting range for the upper rerence value (LOWER)		0.001 to 1.200 Ω
Resolution		0.001 Ω
Judgement accuracy		± (2 % of UPPER + 0.003 Ω)
Calibration		Calibration is performed with the rms value of the sine wave, using a pure resistance load.
LED	PASS	Lights for approximately 0.2 sec when the measured value has been judged as PASS.It is lit continuously when the PASS holding time is set to HOLD.
	UPPER FAIL	Lights if a resistance value equal to or greater than the upper reference value is detected and judged FAIL.
	LOWER FAIL	Lights if a resistance value equal to or greater than the upper reference value is detected and judged FAIL.

Buzzer		•The buzzer sounds for the pass holding time has been set if the measured value has been judged as PASS. •The buzzer sounds continuously under the following condition: The measured value has been judged as PASS when the PASS holding time is set to HOLD. The measured value has been judged as UPPER FAIL. The measured value has been judged as LOWER FAIL. •The buzzer volume for FAIL or PASS judgment are adjustable. Note that it cannot be adjusted individually since setting is shared with the setting for PASS.
Time		
Test Time	Setting range	0.3 to 999 s Timer ON/OFF function is available.
	Accuracy	± (100 ppm of setting + 20 ms)
Environment		
Operating environment		Indoor use, Overvoltage Category II
Warranty range		Temperature: 5 ° to 35 °C Humidity: 20 %rh to 80 %rh (non condensing)
Operating range		Temperature: 0 ° to 40 °C Humidity: 20 %rh to 80 %rh (non condensing)
Storage range		Temperature: -20 ° to 70 °C Humidity: 90 %rh or less (non condensing)
Altitude		Up to 2000 m
Power requirement		
Allowable voltage range		100 V model: 85 to 132 V AC
		100 V/200 V model: 85 to 132 V AC/170 to 250 V AC
Power consumption	At no load (READY)	100 V model: 70 VA or less
		100 V/200 V model : 60 VA or less
	At rated load	100 V model: 450 VA max.
		100 V/200 V model: 330 VA max.
Allowable frequency range		47 Hz to 63 Hz
Insulation resistance		30MΩ min. (500 V DC), between AC line and chassis
Hipot		1390 V AC (2 seconds), between AC line and chassis
Ground bond		25 A AC/0.1 Ω max.
Safety *3 Conforms to the requirements of the following directive and standard.		
Low Voltage Directive 2006/95/EC, EN61010-1, Class I, Pollution degree 2		
Electromagnetic compatibility (EMC) *3 *4		
Conforms to the requirements of the following directive and standard. EMC Directive 2004/108/EC, EN61326, EN61000-3-2, EN61000-3-3 Under following conditions 1. Used test leadwire (TL11-TOS) which is supplied. 2. Used the shielded cable which length is less than three meters when the SIGNAL I/O is used.		
Physical dimensions (max)		430(455)W × 88(140)H × 270(345)Dmm
Weight		Approx. 9 kg
Accessories		
AC power cord		1 piece
Test leadwire TL11-TOS		1 set
Short bar		2 pieces (These are inserted between the OUTPUT and SAMPLING terminals.)
AC power fuse		2 pieces (2, including one spare in the fuse holder)
Operation manual		1 copy

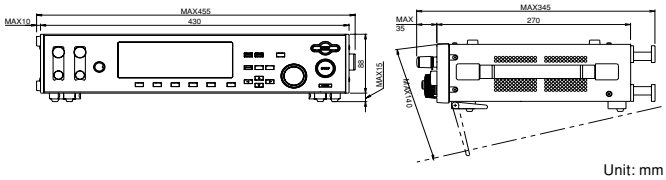
*1 Time limitation with respect to output
The heat radiation capacity at the output block of the tester is designed to be one-third of the rated output, accounting for size, weight, cost, and other factors. Always use the tester within the limitation values given below. Use of the tester beyond these limits will cause the temperature of the output block to rise excessively, potentially tripping the internal protection circuit. In this case, suspend testing for approximately 30 minutes, then press the STOP switch. When temperatures fall to normal levels, the tester will revert to ready status.

Output time limitation

Ambient temperature t (°C)	Test current I (A)	Pause time	Maximum allowable continuous test time
t ≤ 40°	15 < I ≤ 30	Equal to or greater than the test time	≤ 30 minutes
	I ≤ 15	Not required	Continuous output possible

*2 About ohmmeter's response time
A resistance value is instantaneously obtained, calculated using the measured voltage and current values. The response time of the ohmmeter complies with the response times of the voltmeter and ammeter.
*3 Not applicable to custom order models.
*4 Only on models that have CE marking on the panel.

External Dimensional Diagrams



Unit: mm

Leakage Current Tester

TOS3200

GPIB RS-232C USB CE

Features

- Measures leakage current in 3 operation modes: Touch Current (TC), Protective Conductor Current (PCC), and METER mode
- Eight types of measuring circuit networks are incorporated in the tester for measuring the touch current of general electrical apparatuses
- Possible to measure DC/RMS/PEAK, realizing the "true root-mean-square value" with 30 mA as the maximum RMS
- User-friendly operability
- Possible to choose between Independent and Automatic Testing
- 51 types of preset safety standard tests
- Function for controlling the calibration expiration limits

Complying with various safety standards for general electrical equipment, this tester is used for touch current and protective conductor current tests!!

The Leakage Current Tester TOS3200 is designed to test for leakage current (Touch Current and Protective Conductor Current) of general electrical apparatuses, excluding those used for medical purposes. With this tester, you can conduct tests conforming to various standards including IEC, UL, JIS and Electrical Appliance and Material Safety Law (Japan). You can set test conditions through simple operations on the panel because this tester holds in its memory the 51 types of test conditions for IT-related electrical equipment, electrical appliances, audio & visual equipment, lighting fixtures, power tools, and measuring and control instruments, accordingly with the standards of IEC/JIS and Electrical Appliance and Material Safety Law.

Dimensions / Weight

320(12.6″)W × 88(3.47″)H × 270(10.63″)Dmm / 5kg(11.02 lbs)

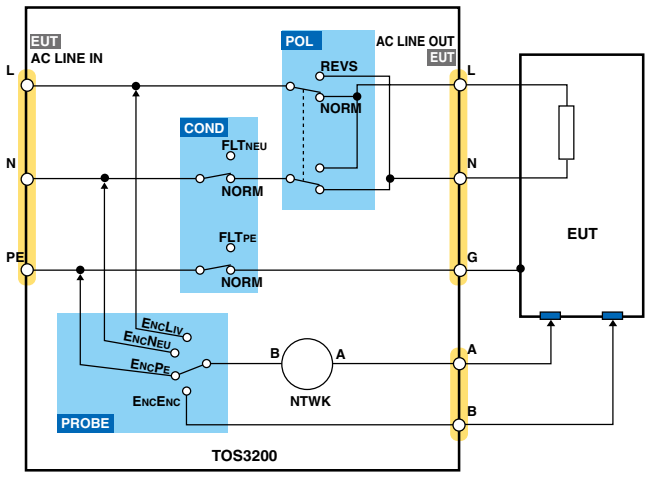
Accessories

AC power cord (2pcs.), Test leadwire TL21-TOS, Flat probe FP01-TOS, Fuse (2pcs.), Operation manual, Circuit principle drawing seal

● Three modes are available for leakage current measurements/Operation panel

TC (Touch Current) operation mode

In this mode, the tester measures the touch current running across enclosure surfaces (parts that can be touched) and the power line including the ground line of equipment under test (EUT) via a humanoid measuring instrument with circuit. Humanoid measuring instrument with circuit is equipped with eight types of measuring circuit networks (NTWK) as standard. The polarity change of the power line to the EUT and single fault condition are automatically set by the relays inside the tester.



[Conceptual diagram of the TC measurement]

PCC (Protective Conductor Current) operation mode

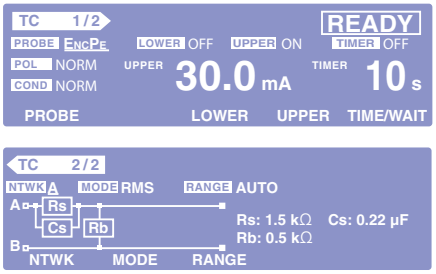
In this mode, the tester measures the current running on the protective conductor (ground line) of an electrical equipment with its power supply plug (equivalent to NEMA5-15) connected to the power outlet on the front panel of the tester. A Multi-outlet Unit (option) is available for various types of electrical plugs used in different regions of the world.

METER operation mode

With its measuring probes A and B on the front panel, the tester measures the voltage or current of the EUT in the same way as a multi-meter. When measuring voltage, SELV (Safety Extra Low Voltage) detection function can be used while current is measured by utilizing the measuring circuit network (NTWK).

Excellent operability

The self-explanatory test condition menu screen, function keys, and rotary control knob successfully make tester operation very easy.



[Setting screen for TC measurement]

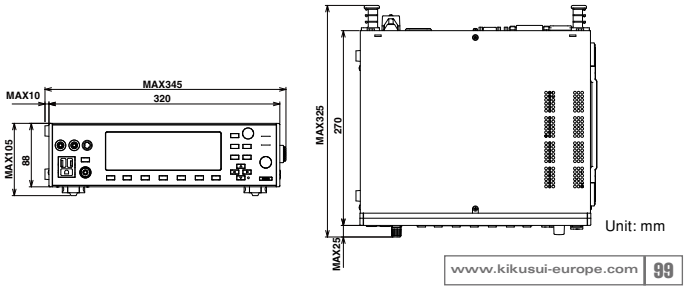
TOS3200 Specifications

Measurement item, measurement mode			
Measurement item			3 types, namely, touch current (TC) measurement, protective conductor current (PCC) measurement, and METER
Measurement method	TC		Measure the voltage drop across the reference resistor, using a measurement circuit network (NTWK), and then calculate the current.
	PCC		Measure the voltage drop across the reference resistor connected to the protective earth wire, and then calculate the current.
	METER		Measure the voltage and current using the measurement terminals.
Measurement mode			DC/RMS/PEAK (RMS being the true root-mean-square value)
Measurement circuit network (NTWK)	Network A		Basic measurement element: (1.5 kΩ//0.22 mF) + 500 Ω
	Network B/B1		Basic measurement element: (1.5 kΩ//0.22 mF) + 500 Ω//(10 kΩ + 0.022 mF)
	Network C		Basic measurement element: (1.5 kΩ//0.22 mF) + 500 Ω//(10 kΩ + (20 kΩ + 6.2 nF)//9.1 nF)
	Network D		Basic measurement element: 1 kΩ
	Network E		Basic measurement element: 1 kΩ//(10 kΩ + 11.225 nF + 579 Ω)
	Network F		Basic measurement element: 1.5 kΩ//0.15 mF
	Network G		Basic measurement element: 2 kΩ
Network constant tolerance			Resistance: ±0.1 %, capacitor 0.15 mF: ±2 %, other: ± 1%
Current measurement section			
Measurement range	Range 1		DC/RMS: 30 mA to 600 mA, PEAK: 50 mA to 850 mA *3
	Range 2		DC/RMS: 125 mA to 6.00 mA, PEAK: 175 mA to 8.50 mA *3
	Range 3		DC/RMS: 1.25 mA to 30.0 mA, PEAK: 1.75 mA to 90.0 mA *3
Range switching			AUTO/FIX
Measured current (i) display/ resolution			i < 1mA: □□□ mA/1 mA, 1 mA ≤ i < 10 mA: □.□□ mA/0.01 mA 10 mA ≤ i < 100 mA: □□.□ mA/0.1 mA
Measurement accuracy *5	Range 1	DC	±(5.0% of rdng + 20 mA)
		RMS	15 Hz ≤ f ≤ 10 kHz: ±(2.0 % of rdng + 8 mA)
			10 kHz < f ≤ 1 MHz: ±(5.0 % of rdng + 10 mA)
		PEAK	15 Hz ≤ f ≤ 10 kHz: ±(5.0 % of rdng + 10 mA)
	Range 2	DC	±(5.0 % of rdng + 50 mA)
		RMS	15 Hz ≤ f ≤ 10 kHz: ±(2.0 % of rdng + 20 mA)
			10 kHz < f ≤ 1 MHz: ±(5.0 % of rdng + 20 mA)
		PEAK	15 Hz ≤ f ≤ 1 kHz: ± (2.0 % of rdng + 50 mA)
			1 kHz < f ≤ 10 kHz: ± (5.0 % of rdng + 50 mA)
	Range 3	DC	±(5.0 % of rdng + 50 mA)
		RMS	15 Hz ≤ f ≤ 10 kHz: ±(2.0 % of rdng + 20 mA)
			10 kHz < f ≤ 1 MHz: ±(5.0 % of rdng + 20 mA)
		PEAK	15 Hz ≤ f ≤ 1 kHz: ± (2.0 % of rdng + 50 mA)
			1 kHz < f ≤ 10 kHz: ± (5.0 % of rdng + 50 mA)
Input resistance, input capacitance			1 MW±1 %, < 200 pF
Common mode rejection ratio			f ≤ 10 kHz: 60 dB or greater, 10 kHz < f ≤ 1 MHz: 40 dB or greater
Judgement function			
Judgement method			Pass/fail judgement by setting upper and lower current limits in window comparator mode
Judgement			U-FAIL for currents above the upper limit; L-FAIL for currents below the lower limit.
Display, etc.			U-FAIL/L-FAIL/PASS display, buzzer sounding
PASS hold			The time for which a PASS judgement is retained can be set to 0.2 s to 10.0 s or to HOLD
Setting range	Range 1		DC/RMS: 30 mA to 600 mA, PEAK: 50 mA to 850 mA *4
	Range 2		DC/RMS: 151 mA to 6.00 mA, PEAK: 213 mA to 8.50 mA *4
	Range 3		DC/RMS: 1.51 mA to 30.0 mA, PEAK: 2.13 mA to 90.0 mA *4
Judgement accuracy			Conforms to measurement accuracy. (Read rdng as set.)
Measurement of voltage between A and B			
Measurement range			DC/RMS: 10.000 V to 300.0 V, PEAK: 15.000 V to 430.0 V
Accuracy			±(3 % of rdng + 2 V), measurement range fixed at AUTO
Input impedance			Approx. 40 MΩ
SELV detection			Set the SELV to detect; if this value is exceeded, the DANGER lamp is turned ON
SELV setting range			10 V to 99 V, in 1-V steps, OFF function provided
Timer, test execution function, memory			
Timer	Test wait time		Setting range: 0 s to 999 s, accuracy: ±(100 ppm of set + 20 ms)
	Test time		Setting range: 1 s to 999 s/OFF function, accuracy: ±(100 ppm of set + 20 ms)
Text execution			Auto test (AUTO): Automatic execution of up to 100 steps (test conditions) Independent test (MANUAL): Independent execution of TC, PCC, or METER measurement
Memory	Test conditions		UTO: Up to 100 sequence programs can be saved (up to 500 steps in total). MANUAL: Up to 100 sequence programs can be saved.
	Test results		The user can select whether to save the judgement results when they are output at the end of the tests. AUTO: Test results for up to 50 programs can be recorded. MANUAL: Test results for up to 50 tests can be recorded.

• The warm-up time must be 30 minutes or longer.
• rdng denotes a reading, set denotes the set value, and EUT is the electrical equipment under test.
*1 May not apply to custom-made or modified products.
*2 Limited to products with CE marking on their panels.
*3 The maximum range is indicated. The range differs depending on the measurement circuit network.
*4 The maximum range is indicated. The range differs depending on the measurement circuit network. Also, the UPPER setting in each range when the FIX range is selected is indicated.
*5 Current converted value in Network A,B,C and PCC measurement,based on built-in voltmeter accuracy.

Other functions		
Measured value conversion (CONV)		Converts the measured current value into the corresponding value at the preset power voltage
		Setting range: 80.0 V to 300.0 V, OFF function provided
MEASURE MODE		Selects a measured value from those below
		NORM: Displays the measured value in the measurement period
		MAX: Displays the largest measured value in the measurement period
Power positive/negative phase selection (POL)		NORM: Positive phase connection, REVS: Negative phase connection
Single fault selection (COND)		NORM: Normal, FLTNEU: Disconnection of the neutral wire, FLTPE: Disconnection of the protective earth wire
Earth check		Generates CONTACTFAIL if the enclosure is grounded in a TC (EncLiv, EncNeu) test
MEASURE CHECK		Checks the measurement function between measurement terminals A and B, and places the tester in the PROTECTION state if an error is detected
Voltage measurement(EUT)		Measurement range: 80.0 V to 250.0 V, resolution: 0.1 V, accuracy: ±(3 % of rdng + 1 V)
Current measurement(EUT)		Measurement range: 0.1 A to 15.00 A, resolution: 0.01 A, accuracy: ±(5 % of rdng + 30 mA)
Power measurement (effective power)		Measurement range: 10 W to 1500 W
		Accuracy (at a power voltage of 80 V or higher and a load power factor of 1): ±(5 % of rdng + 8 W)
System clock	Recording	Items: Calibration date and time, test date and time, permissible date and time: Up to 2099
	Calibration time limit	Enables the setting of a calibration time limit. Once this time has passed, a warning is output at power on
	management (CAL PROTECT)	ON: Places the tester in the PROTECTION state (disables the use of the tester), OFF: Displays warning.
Protective operation		Relay operation error, overload, over range, measurement function check, failure of internal battery, etc.
Interface		
RS-232C		D-Sub 9-pin connector (conforming to EIA-232D), baud rate: 9600/19200/ 38400 bps (For connection to a PC, use a "9-pin female-female reverse" cable.)
GPIB		Conforms to IEEE Std. 488-1978. (SH1,AH1,T6,TE0,L4,LE0,SR1,PP0,DC1,DT0,C0,E1)
USB		USB Specification2.0
REMOTE		6-pin MINIDIN connector (for HP21-TOS (separately sold option) only)
SIGNAL I/O		25-pin D-Sub connector
General		
Measure-ment erminals	Rated voltage/current	Terminals A to B: 250 V, terminal to chassis: 250 V, 100 mA
	Measurement category	CAT II
	Effective terminal display	Terminals effective to measurement are indicated with LED lamps
Environ-ment	Specification assured range	Temperature: 5 ˚C to 35 ˚C, humidity: 20 % rh to 80 % rh (no condensation)
	Operating range	Temperature: 0 ˚C to 40 ˚C, humidity: 20 % rh to 80 % rh (no condensation)
	Storage range	Temperature: –20 ˚C to 70 ˚C, humidity: 90 % rh or less (no condensation)
	Mounting location	Indoors, altitude of 2000 m or less
Power	Input power	Nominal input rating:100Vac to 240Vac, 50/60Hz, power consumption: 70 VA max.
	for EUT	Nominal input rating:100 Vac to 240Vac, 50/60 Hz
		Rated output capacity: 1500 VA, maximum current: 15 A, rush current: 70 A peak max. (within 20 ms)
Insulation resistance		30 MΩ or greater (500 Vdc) (between AC line and chassis, between measurement terminal and chassis)
Withstand voltage		1390 Vac, 2 seconds/20 mA or less (between AC line and chassis)
Ground bond		25 Aac/0.1 Ω or less
Safety *1		Conforms to the requirements of the directive and standard below. Low Voltage Directive 2006/95/EC, EN61010-1 (Class I, Pollution degree 2)
Electromagnetic compatibility *1 *2		Conforms to the requirements of the directive and standard below. EMC Directive 2004/108/EC, EN61326, EN61000-3-2, EN61000-3-3, Applicable conditions: All cables and wires used to connect to this product must be shorter than 3 meters.Use the supplied test leads.
Outside dimensions, weight		320 (345) W x 88 (105) H x 270 (335) D mm, approx. 5 kg
Accessories		1 set of test leads (TL21-TOS: red and black, one each, with alligator clips) 1 flat probe (FP01-TOS), 1 spare fuse (15A, for EUT power) 1 instruction manual, 1 circuit principle diagram sticker 2 power cords (for the tester and for the EUT AC line)

External Dimensional Diagrams



Unit: mm

Options for Electrical Safety Testers

■ Test Lead

TL01-TOS
[cable length: 1.5 m/max. operating voltage: 5 kV]

TL02-TOS
[cable length: 3 m/max. operating voltage: 5 kV]

TL03-TOS
[cable length: 1.5 m/max. operating voltage: 10 kV]

TL04-TOS
[cable length: 1.5 m/max. operating voltage: 5 kV (for TOS1200, RL01-TOS)]

TL05-TOS
[cable length: 1.5 m/max. operating voltage: 5 kV(for 149-10A, RL01-TOS)]

TL06-TOS
[cable length: 0.5 m/max. operating voltage: 5 kV (for parallel connection of TOS9220/9221)]

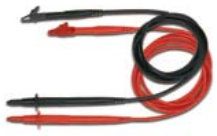
TL07-TOS
[cable length: 1.5 m/max. operating voltage: 5 kV(for TOS9220/9221)]

TL08-TOS
[cable length: 1.5 m/max. operating voltage: 1 kV(for TOS7200)]

TL11-TOS
[cable length: 1.5 m/max. operating current: 30 A(for TOS6200)]

TL12-TOS
[cable length: 1.5 m/max. operating current: 60 A(for TOS6210)]

TL21-TOS
(for TOS3200)



HTL-2.5DH
[cable length: 1.5 m/max. operating voltage: 10 kV(for 149-10A)]

■Test Probe

HP01A-TOS *1 *2
[cable length: 1.8 m/max. operating voltage: 4 kV AC(RMS), 5kV DC]
HP02A-TOS *1 *2
[cable length: 3.5 m/max. operating voltage: 4 kV AC(RMS), 5kV DC]

HP11-TOS
[cable length: 1.8 m/max. operating voltage: 1kV DC/max. operating current: 100mA(for TOS7200)]

HP21-TOS
[cable length: 1.8 m/max.operating voltage: 250 Vrms/max.operating current: 100 mA (for TOS3200)]

FP01-TOS
(flat probe for TOS3200)

LP01-TOS
[cable length: 2 m/max. operating current: 30 A(for TOS6200)].

LP02-TOS
[cable length: 2 m/max. operating current: 60 A(for TOS6210)]

*1 This can not be used with TOS7200.
*2 The optional adaptor DD-5P/9P is required for the connection with TOS5300 Series.

■ Remote Control Box

RC01-TOS *3 *4
[one-hand operation/dimensions: 200(7.87″)W × 70(2.76″)H × 39(1.54″)D mm/cable length: 1.5 m]

RC02-TOS *3 *4
[both-hands operation/dimensions: 330(12.99″)W × 70(2.76″)H × 39(1.54″)D mm/cable length: 1.5 m]

■ DIN Cable

DD-3 5P
[Cable length: 3m/DIN plug to DIN plug]

DD-5P/6P
[Adaptor/DIN to Mini DIN]

*3 The optional adaptor DD-5P/6P is required for the connection with TOS7200.
*4 The optional adaptor DD-5P/6P is required for the connection with TOS5300 Series.

■ Warning Light Unit

PL01-TOS (for 100V AC)
*This can not be used with TOS6200, TOS9200/9201, TOS7200, TOS5300 Series.

PL02-TOS (for 24V DC)
* for TOS9200/9201, TOS5300 Series.

■ Buzzer Unit

BZ01-TOS (for 100V AC)
*This can not be used with TOS6200, TOS9200/9201, TOS7200, TOS5300 Series.

■ Multi Outlet

OT01-TOS
(multi outlet for TOS3200)

Options for Electrical Safety Testers

■ Software for TOS5000A

SD004-TOS5000A
(Data acquisition for TOS5051A/5050A)

For the details, please refer to 89 page.

EIA Standard Rack (Inch Size) Mounting Options

Product name	Bracket	
	Model name	Panel width (*1)
TOS9201	KRB3-TOS	3
TOS9213S	KRB3-TOS	3
TOS9200	KRB3-TOS	3
TOS9220	KRB2-TOS	2
TOS9221	KRB2-TOS	2
TOS5300	KRA4-TOS	4
TOS5301	KRA4-TOS	4
TOS5302	KRA4-TOS	4
TOS6210	KRB2-TOS	2
TOS6200	KRB2-TOS	2
TOS3200	KRA3-TOS	3

*1 : EIA panel width is 44.45 mm (1 3/4 inch). The panel width does not include the rubber feet, casters, and levelers.

JIS Standard Rack (Millimeter Size) Mounting Options

Product name	Bracket	
	Model name	Panel width (*2)
TOS9201	KRB150-TOS	3
TOS9213S	KRB150-TOS	3
TOS9200	KRB150-TOS	3
TOS9220	KRB100-TOS	2
TOS9221	KRB100-TOS	2
TOS5300	KRA200-TOS	4
TOS5301	KRA200-TOS	4
TOS5302	KRA200-TOS	4
TOS6210	KRB100-TOS	2
TOS6200	KRB100-TOS	2
TOS3200	KRA150-TOS	3

*2 : JIS panel width is 50 mm. The panel width does not include the rubber feet, casters, and levelers.

Digital Multimeter

DME1600

GPIB USB CE

DME1600GC

NEW

6 1/2 digit resolution, Essential device of "Electronic Measurement" Supporting basic measurement with variety of options

The DME1600 is a digital multi-meter with a resolution of 6 1/2 digit. It can be performed up to 2000 times per second at the setting condition of 4 1/2 digit as fastest measurement, and it can measures 50 times per second when it is set for the 6 1/2 digit. The DME1600 offers fully function of measurement for the voltage, current, resistance, frequency and temperature which can be used various application of measurement and evaluation in design, development and debugging of electronics devices. The DME1600 provides USB and GPIB interface* as standard feature for automated measurement besides manual operation.
Furthermore, the DME1600 offers wide range of options such as 20-channel multi-point scanner card supporting the basic measurement.

Lineup

DME1600
DME1600GC (with GPIB)

Dimensions / Weight

224(8.82″)W × 113(4.45″)H × 373(14.69″)D mm / 4.4kg(9.7lbs)

Accessories

Power cable(with 3P plug), Test Lead(1 each for Red, Black), USB cable, CD-R(Contains Operation Manual, Application Software), For Safety documents, Packing list

Features

- Resolution: 6 1/2 digit
- Display: 5 x 7 dot matrix VFD, dual display with 3-color
- Basic measurement function: DC voltage[0.1 V, 1 V, 10 V, 100 V, 1000 V], AC voltage [0.1 V, 1 V, 10 V, 100 V, 750 V], DC current [10 mA, 100 mA, 1 A, 3 A], AC current [1 A, 3 A], 2-wire/4-wire resistance [100 Ω, 1 kΩ, 10 kΩ, 100 kΩ, 1 MΩ, 10 MΩ, 100 MΩ], Frequency [3 Hz to 300 kHz], Continuity test, Diode test, Temperature test
- Built-in USB Interface (GPIB Interface*: selected model)

*Model with GPIB Interface: DME1600GC

Options

- 20-channel multi-point scanner card
DME1600-OPT09
- 10-channel multi-point scanner card
DME1600-OPT01
- 10-channel thermocouple multi-point scanner card
DME1600-OPT12
- Kelvin probe(for 4-wire resistance measurement)
DME1600-OPT07
- 4-wire test lead
DME1600-OPT08
- Thermocouple adapter
DME1600-OPT02
- K type thermocouple cable
DME1600-OPT11

DME1600 Specifications

DC Characteristics

Accuracy

- ± (%of reading + %of range)
- 6 1/2 digit resolution, measured by Auto Trigger mode after the unit has been warmed up more than two hours.
- For the resistance measurement, it applies to use either 4-wires resistance measurement or 2-wires resistance measurement of the Null function.

DC Voltage			
Range	Resolution	Input Resistance	1 year (23 °C ± 5)
100.0000 mV	0.1 µV	> 10 GΩ	0.0050+0.0035
1.000000 V	1.0 µV	> 10 GΩ	0.0040+0.0007
10.00000 V	10 µV	> 10 GΩ	0.0035+0.0005
100.0000 V	100 µV	10 MΩ	0.0045+0.0006
1000.000 V	1 mV	10 MΩ	0.0045+0.0010
DC Current			
Range	Resolution	Shunt Resistance	1 year (23 °C ± 5)
10.00000 mA	10 nA	5.1 Ω	0.050+0.020
100.0000 mA	100 nA	5.1 Ω	0.050+0.005
1.000000 A	1 µA	0.1 Ω	0.100+0.010
3.000000 A	10 µA	0.1 Ω	0.120+0.020
Resistance			
Range	Resolution	Test Current	1 year (23 °C ± 5)
100.0000 Ω	100 µΩ	1 mA	0.010+0.004
1.000000 kΩ	1 mΩ	1 mA	0.010+0.001
10.00000 kΩ	10 mΩ	100 µA	0.010+0.001
100.0000 kΩ	100 mΩ	10 µA	0.010+0.001
1.000000 MΩ	1 Ω	5 µA	0.010+0.001
10.00000 MΩ	10 Ω	500 nA	0.040+0.001
100.0000 MΩ	100 Ω	500 nA||10 MΩ	0.800+0.010
Diode Test			
Range	Resolution	Test Current	1 year (23 °C ± 5)
1.0000 V	10 µV	1 mA	0.010+0.020
Continuity			
Range	Resolution	Test Current	1 year (23 °C ± 5)
1000.00 kΩ	10 mΩ	1 mA	0.010+0.030

Measuring Characteristics

Item	Specifications
DC voltage measurement : Over range	Capable 20 % of the over range excluding "1,000 V range"
DC voltage measurement : Input bias current	Less than 30 pA (at 25)
DC voltage measurement : Input voltage protection	1,000 V for all ranges
DC current measurement : Over range	Capable 20 % of the over range excluding "3 A range"
Resistance measurement : Maximum resistance value for usable test lead	10 Ω (100 Ω range) 100 Ω (1kΩ range) 1kΩ (Other ranges)
Resistance measurement : Input voltage protection	1,000 V for all ranges

Frequency and Period

Accuracy

- ± (%of reading)
- 6 1/2 digit resolution, measured after the unit has been warmed up more than two hours.

Range	Frequency	1 year (23 °C ± 5)
100 mV RMS to 750 V RMS	3 Hz to 5 Hz	0.10
	5 Hz to 10 Hz	0.05
	10 Hz to 40 Hz	0.03
	40 Hz to 300 kHz	0.01

Measuring Characteristics

Item	Specifications
Over range	Capable 20 % of the over range excluding "750 V RMS Range"
Measuring frequency	750 V RMS Range is limited to100 kHz

AC Characteristics

Accuracy

- ± (%of reading + %of range)
- Specifications are for 2-hours warm-up at 6 1/2 digit, slow AC filter with Bandwidth 3Hz, sine wave input.
- Measured by the sine-wave input exceeding 5% of the range
- For the input range from 1% to 5%, add 0.1% of the range (when it is less than 50kHz) or adding 0.13% of the range (when it is from 50kHz to 100kHz)

AC Voltage (TRMS)			
Range	Resolution	Frequency	1 year (23 °C ± 5)
100.0000 mV	0.1 µV	3 Hz to 5 Hz	1.00+0.04
		5 Hz to 10 Hz	0.35+0.04
		10 Hz to 20 kHz	0.06+0.04
		20 kHz to 50 kHz	0.12+0.05
		50 kHz to 100 kHz	0.60+0.08
		100 kHz to 300 kHz	4.00+0.50
1.000000 V to 750.000 V	1.0 µV to 1 mV	3 Hz to 5 Hz	1.00+0.03
		5 Hz to 10 Hz	0.35+0.03
		10 Hz to 20 kHz	0.06+0.03
		20 kHz to 50 kHz	0.12+0.05
		50 kHz to 100 kHz	0.60+0.08
		100 kHz to 300 kHz	4.00+0.50
AC Current (TRMS)			
Range	Resolution	Frequency	1 year (23 °C ± 5)
1.000000 A	1 µA	3 Hz to 5 Hz	1.00+0.04
		5 Hz to 10 Hz	0.30+0.04
		10 Hz to 5 kHz	0.10+0.04
3.000000 A	10 µA	3 Hz to 5 Hz	1.10+0.06
		5 Hz to 10 Hz	0.35+0.06
		10 Hz to 5 kHz	0.15+0.06

Measuring Characteristics

Item	Specifications
Over range	Capable 20% of the over range excluding "750V RMS range" and "3A range"
Measuring frequency	750 V RMS Range is limited to100 kHz

General

Item	Specifications
voltage range	100 Vac/120 Vac/220 Vac/240 Vac ± 10 % (single phase)
frequency range	50 Hz/60 Hz ± 10 %
Power consumption	25 VAmax
Operating Temperature range	0 to 50
Operating Humidity range	Up to 80 %rh (0 to 31, non condensing)
Storage Temperature range	-10 to 60
Operating Altitude	Up to 2000 m
Dimensions / Weight	224 W×113 H×373 D mm/approx 4.4 kg
Interfaces	USB, GPIB (only GC, SG)
Accessories	"Power cable" 1pc. (with 3P plug), "Test Lead" (1 each for Red, Black), "USB cable" 1pc., "CD-ROM"* 1pc., "For Safety documents" 2pcs. (1 each for English, Japanese) , Packing list 1pc. (English/Japanese)
Electromagnetic compatibility (EMC)	Conforms to the requirements of the following directive and standard. EMC Directive 2004/108/EC EMC: EN61326-1:2006 EMI: CISPR 11:1997+A1:1999+A2:2002 Class B IEC61000-3-2:2000 IEC61000-3-3:1994+A1:2001 EMS: IEC61000-4-2:1995+A1:1998+A2:2000 IEC61000-4-3:2002 IEC61000-4-4:2004 IEC61000-4-5:1995+A1:2000 IEC61000-4-6:2003 IEC61000-4-8:1993+A1:2000 IEC61000-4-11:2004
Safety	Conforms to the requirements of the following directive and standard. IEC61010-1:2001/ EN 6010-1:2001 (2nd Edition)

*Including "Operation manual (PDF)" and "Application Software"

Function Generator

FGA5050

GPIB (FGA5050GC) LAN LXI USB CE

NEW

50MHz Arbitrary Waveform Generator

The LXI interface makes easier for the test system!

The FGA5050 is a function generator that equips with the arbitrary waveform function. In addition to Sine waveform, Square waveform, Ramp waveform of those custom waveform generation function, the FGA5050 offers to realize high precision waveform with 1 µHz of resolution and 50MHz of wideband frequency. The FGA5050 can be used in wide application such as "Voltage variation test for Automotive Electronic Components", "ECU false signal source", "Charge-Discharge test for the rechargeable battery", "Ripple super-impose test" and it can be used as the trigger signal for the various type of test system. Further more, three types of interface, LAN / USB / GPIB* are equipped with the FGA5050 as standard feature, it applies for automated test along with manual operation.

Lineup

FGA5050
FGA5050GC (with GPIB)

Dimensions / Weight

214(8.82″)W × 107(4.21″)H × 380(15.0″)D mm / 4kg(8.8lbs)

Accessories

Power cable(with 3P plug), Pattern generator cable, USB cable, CD-R(Contains Operation Manual, the Communication Interface Manual), For Safety documents(1 each for English, Japanese), Packing list(English/Japanese)

Features

- Wide band frequency
  Sine waveform: 1 µHz to 50 MHz, Square waveform: 1 µHz to 25 MHz
- Sine waveform, Square waveform, Ramp waveform, Triangle waveform, Pulse waveform, Noise waveform, DC, Arbitrary waveform output
- Waveform Editor Application Software "WAVEPATT" is included as standard
- Various modulation types: AM, FM, PM, FSK, PWM, Frequency sweep, Burst, External Modulation Input
- 16 bits, up to 50 MHz pattern out, 14 bits, 256 K points, 125 M Sample/s Arbitrary waveforms
- 10 MHz clock in and out
- Trigger Input and Trigger output (TTL compatible)
- Interface: LAN/USB/GPIB*standard
  *Model with GPIB Interface: FGA5050GC

FGA5050 Specifications

Waveform Characteristic				
Waveform	Standard waveforms	Sine, Square, Ramp, Triangle, Pulse, Noise, DC		
	Built-in arbitrary waveforms	Exponential Rise and Fall, Negative ramp, Sin(x)/x, cardiac		
Sine	Frequency	1μHz to 50 MHz		
	Amplitude Flatness *1 *2 (Relative to 1 kHz)	< 100 kHz	0.1 dB	
		< 5 MHz	0.15 dB	
		< 20 MHz	0.3 dB	
		< 50 MHz	0.5 dB	
	Harmonic distortion *2 *3	DC to 20 kHz	< 1 Vpp	-70 dBc
			≥ 1 Vpp	-70 dBc
		20 kHz to 100 kHz	< 1 Vpp	-65 dBc
			≥ 1 Vpp	-60 dBc
		100 kHz to 1 MHz	< 1 Vpp	-50 dBc
			≥ 1 Vpp	-45 dBc
		1 MHz to 20 MHz	< 1 Vpp	-40 dBc
			≥ 1 Vpp	-35 dBc
		20 MHz to 50 MHz	< 1 Vpp	-35 dBc
			≥ 1 Vpp	-30 dBc
	Total Harmonic distortion	DC to 20 kHz	< 0.5 Vpp	≤ 0.06 %
	Spurious *2 *4 (non-harmonic)	DC to 1 MHz		-70 dBc
		1 MHz to 50 MHz		-70 dBc+6 db/ octave
	Phase Noise (10 kHz Offset)	≥ 1 MHz	≥ 0.1 Vpp	-115 dBc/Hz typical
Square	Frequency	1μHz to 25 MHz		
	Rise / Fall time	< 10 ns		
	Overshoot	< 2 %		
	Variable Duty Cycle	< 10 MHz	20 % to 80 %	
		< 25 MHz	40 % to 60 %	
	Asymmetry	1%of period +5 ns (@50 % duty)		
	Jitter (RMS)	≥ 0.1 Vpp ≥ 1 MHz	200 ps	
Ramp, Triangle	Frequency	1μHz to 200 kHz		
	Linearity	< 0.1 % of peak output		
	Symmetry	0.0 % to 100.0 %		
Pulse	Frequency	500μHz to 10 MHz		
	Pulse width	20 ns minimum		
		10 ns res. (period ≤ 10 s)		
	Variable Edge Time	< 10 ns to 100 ns		
	Overshoot	< 2 %		
	Jitter (RMS)	≥ 0.1 Vpp ≥ 50 kHz	200 ps	
Noise	Bandwidth	20 MHz typical		
Arbitrary	Frequency	1μHz to 10 MHz		
	Length	2 K to 256 K		
	Resolution	14 bits (including sign)		
	Sample Rate	125 M Sa/s		
	Min Rise / Fall time	30 ns typical		
	Linearity	< 0.1 % of peak output		
	Setting Time	< 250 ns to 0.5 % of finai value		
	Jitter (RMS)	6 ns+300 ppm		
	Non-voltage Memory	4 Waveforms *256 K points		

Common Characteristic		
Frequency	Resolution	1 μHz
Amplitude	Range	10 mVpp to 10 Vpp in 50 Ω
		20 mVpp to 20 Vpp in No Load (open-circuited)
	Accuracy *2 *5 (at 1 kHz)	±1 % of setting ± 1 mVpp
	Units	Vpp, Vrms, dBm
	Resolution	4 digits
DC Offset	Range	±5 V in 50 Ω
		±10 V in No Load (open-circuited)
	Accuracy *2 *5 (at 1 kHz)	±2 % of offset setting ±0.5 % of amplitude setting
	Resolution	4 digits
Main Output	Impedance	50 Ω typical
	Isolation	42 Vpeak maximum to earth
	Protection	Short-circuit protection, Stop the output automatically at the state of over-load
Internal Frequency	Accuracy *5	±10 ppm in 90 days
		±20 ppm in 1 years
External Frequency Input	Lock Range	10 MHz ± 500 Hz
	Level	100 mVpp to 5 Vpp
	Impedance	1 kΩ typical, AC coupled
	Lock Time	< 2 sec
External Frequency Output	Lock Range	10 MHz
	Level	632 mVpp (0 dBm) typical
	Impedance	50 Ω typical, AC coupled
Phase Offset	range	-360 ° to +360 °
	Resolution	0.001 °

Modulation		
Modulation Type	AM, FM, PM, FSK, PWM, SWEEP and BURST	
AM	Carrier	Sine, Square, Ramp, Arb
	Source	Internal/External
	Internal Modulation	Sine, Square, Ramp, Triangle, Noise, Arb
	Frequency (Internal)	2 mHz to 20 kHz
	Depth	0.0 % to 120.0 %
FM	Carrier	Sine, Square, Ramp, Arb
	Source	Internal/External
	Internal Modulation	Sine, Square, Ramp, Triangle, Noise, Arb
	Frequency (Internal)	2 mHz to 20 kHz
	Deviation	DC to 25 MHz
PM	Source	Internal/External
	Internal Modulation	Sine, Square, Ramp, Triangle, Noise, Arb
	Frequency (Internal)	2 mHz to 20 kHz
	Deviation	0.0 ° to 360 °
PWM	Carrier	Pulse
	Source	Internal/External
	Internal Modulation	Sine, Square, Ramp, Triangle, Noise, Arb
	Frequency (Internal)	2 mHz to 20 kHz
	Deviation	0 % to 100 % of pulse width
FSK	Carrier	Sine, Square, Ramp, Arb
	Source	Internal/External
	Internal Modulation	50 % duty cycle Square
	Frequency (Internal)	2 mHz to 100 kHz
External Modulation Input *6	Voltage Range	±5 V full scale
	Input Resistance	8.7 kΩ typical
	Bandwidth	DC to 20 kHz
SWEEP	Waveforms	Sine, Square, Ramp, Arb
	Type	Linear, Log
	Direction	Up or Down
	Sweep Time	1 ms to 500 s
	Trigger Source	Internal, External or Manual
	Marker	falling edge of sync signal programmable frequency
BURST	Waveforms*7	Sine, Square, Ramp, Triangle, Noise, Arb
	Type	Internal/External
	Start / Stop Phase	-360 ° to +360 °
	Internal Period	1 μs to 500 s
	Gated Source	External trigger
	Trigger Source	Internal, External or Manual
Trigger Input	Level	TTL compatible
	Slope	Rising or Falling (Selectable)
	Pulse width	≥ 100 ns
	Impedance	≥ 10 kΩ DC coupled
	Latency	< 500 ns
Trigger Output	Level	TTL compatible into ≥ 1 kΩ
	Pulse width	≥ 400 ns
	Impedance	50 Ω typical
	Maximum rate	1 MHz
	Fan-out	≤ 4 FGA5050s

Pattern Mode Characteristic		
Output	Clock Maximum Rate	50 MHz
	Output Level	TTL compatible into ≥ 2 kΩ
	Output Impedance	110 Ω typical
	Pattern Length	2 K to 256 K

General	
voltage/frequency range	100 Vac to 240 Vac (single phase) 50 Hz/60 Hz
Power consumption	80 VAmax
Operating Temperature range	0 to 55
Operating Humidity range	30 %rh(0, 50), 40 %rh(18, 23, 28), 80 %rh(35), non condensing
Storage Temperature range	-40 to 70
Operating Altitude	Up to 2000 m
Dimensions/Weight	224 W×107 H×380 D mm/4.08 kg
Interfaces	LAN, USB, GPIB (only GC)
Accessories	"Power cable" 1pc. (with 3P plug), "Pattern generator cable" 1pc., "USB cable" 1pc., "CD-R"*1pc., Packing list, "For Safety documents" 2pcs. (1 each for English, Japanese)
Electromagnetic compatibility (EMC)	Conforms to the requirements of the following directive and standard. EMC Directive2004/108/EC EMC: EN61326-1:2006 EMI: CISPR 11:2003 Class A IEC61000-3-2:2000 IEC61000-3-3:1994+A1:2001 EMS:IEC61000-4-2:1995+A1:1998+A2:2000 IEC61000-4-3:2002 IEC61000-4-4:2004 IEC61000-4-5:1995+A1:2000 IEC61000-4-6:1996+A1:2000 IEC61000-4-8:1993+A1:2000 IEC61000-4-11:2004
Safety	Conforms to the requirements of the following directive and standard. IEC61010-1:2001/ EN 6010-1:2001 (2nd Edition)

*including the "Operation Manual" and "Communication Interface Manual".

*1 Add 1/10 th of output amplitude and offset spec per for operation outside the range of 18 to 28
*2 Autorange enabled *3 DC offset set to 0 V *4 Spurious output at low amplitude is -75 dBm typical
*5 Add 1 ppm/average for operation outside the range of 18 to 28
*6 FSK uses trigger input (1MHz maximum)
*7 Sine and square waveforms above 10 MHz are allowed only with an "infinite" burst count

Digital Power Meter

KPM1000

GPIB OPTION | RS-232C | USB OPTION | CE

NEW

Dimensions / Weight

214(8.43″)W × 81(3.19″)H × 270(10.63″)D mm / 2.5kg(5.51lbs)

Accessories

AC power cable, Safety plug, CD-R(Contains Operation Manual, Application Software), Quick start(1 each for English, Japanese), For Safety documents, Packing list

Options

■ Test Lead
TL40
■ Safety plug
TL41 (connection by the screw)
TL42 (connection by the solder)
TL43 (connection by the clamp)
■ Alligator clip
TL44
■ Fork terminal adapter
TL45
■ Application software
(Complied to the testing of IEC62301 Ed1.0)
■ AC receptacle cable
OT01-KPM
■ AC Multi Outlet Cable
OT02-KPM
■ Rack mount adapter
KRA2 (EIA)
KRA100 (JIS)
■ Interface Board
GPIB Interface factory option
USB Interface factory option
*Only one interface board can be installed.

Applies to the power measurement from the micro scale to the large scale!!

The digital power meter, KPM1000, is a measuring instrument that measures the single phase power applied to the extended range from the small consumption such as a standby power to the large scale consumption of power. Through the years, each region of the world has been putting their effort to establish the regulation related to the ecological design such as “ErP Directive” in Europe, “Energy Star” in the US, “Top Runner Method” in Japan, and those standards are widely used by commercial companies while taking advantage from other products as well as an effort to the environment issues. In the “ErP Directive Lot6”, it applies to the standby power consumption (classified in the “Off-mode” and “Standby mode”) of home appliances, and office equipments, and it is required to issue the declaration of conformity for the CE marking.
The KPM1000 complies to the standard of IEC62301 Ed1.0 (Household electrical appliances - Measurement of standby power) and it is capable to measure the standby power consumption required by the “ErP Directive Lot6”. The KPM1000 is a compact , light-weight, low price, and capable to operate with the optional interface (some interfaces are available in factory option). The KPM1000 comes in handy for measuring the power of equipments, and it can be used as an essential device for the test system.

Features

■ Measurement of the standby power consumption
■ High precision measurement - Basic accuracy of the Voltage, Current, Power ±(0.1 % of reading + 0.1 % of range)
■ The dedicated application software(free download from the Web site) enables you to control the KPM1000 through the PC as same as panel operation.
■ Displays 4 measuring items at the same time
■ Easy operation

KPM1000 Specifications

Unless specified otherwise, the specification are for the following settings and conditions.
• The warm-up time is 30 minutes. • After the KPM1000 has been warmed up, it must be calibrated correctly in a 23°C ± 5°C environment.

Input		
Measurement line		Single-phase two-wire (measurement category CAT II)*1
Voltage input terminal		Safety terminal
Current input terminal		M6 terminal block
Measurement rated voltage		300 Vrms
Measurement rated current		20 Arms
Maximum allowable input voltage		900 Vpk or 360 Vrms
Maximum allowable input current		120 Apk or 24 Arms
Maximum isolation voltage		300 V
Input impedance	Voltage input	6 MΩ ± 10 %
(50/60 Hz)	Current input	2 mΩ or less
Line filter (LPF)	Cutoff frequency	500 Hz (ON/OFF possible)

*1 Applies to measurements on circuits directly connected to a low-voltage installation. This category applies to measurements on circuits of equipment on the primary side of a transformer. Such pieces of equipment have a power cord connected to a power outlet. Examples are household appliances and portable tools.

Display items	
Measurement items	Voltage, current, active power, apparent power, reactive power, power factor, phase angle, frequency, integrated current, integrated power, positive direction integrated power, negative direction integrated power, integrated time, voltage crest factor, current crest factor, voltage peak, current peak
Display update interval	100 ms/200 ms/500 ms/1 s/2 s/5 s/10 s
Number of display items	Four-item simultaneous display

Voltage measurement function			
Measurement range	Resolution	150 V	0.01 V
		300 V	0.01 V
Allowable crest factor			3
Accuracy *1 *2	Effective input range	Full range	1 % to 120 % of range
	45 Hz f 66Hz LPF:ON/OFF		± (0.1 % of reading + 0.1 % of range)
	66 Hz< f 400Hz LPF:OFF		± (0.1 % of reading + 0.2 % of range)
	400 Hz< f 1kHz LPF:OFF		± (0.1 % of reading + 0.2 % of range)
	1kHz< f 5kHz LPF:OFF		± (3 % of range)
One-year accuracy (accuracy up to 12 months after calibration)			1.5 times the reading errors for the accuracy at 6 months
Auto range	UP conditions		When the value exceeds 120 % of the range or when a peak over-range occurs
	DOWN condition		When the value is less than 30 % of the range, the value is less than or equal to 90 % of the next lower range, and a peak overrange is not occurring

*1 Under the following conditions: within the effective input range, within six months after the last calibration, at a temperature of 23 °C ± 5 °C, sine wave, power factor of 1, and common mode voltage of 0 V.
If the waveform is asymmetrical (waveforms such as half-wave rectified waveforms and full-wave rectified waveforms), errors will occur.
*2 The peak voltage accuracy is defined for a sine wave whose frequency is between 45 Hz and 66 Hz. Accuracy: ± (0.1 % of reading + 3.1 % of range)

Current measurement function			
Measurement range	Resolution	5 mA	0.0001 mA
		10 mA	0.001 mA
		20 mA	
		50 mA	
		100 mA	0.01 mA
		200 mA	
		500 mA	
		1 A	0.1 mA
		2 A	
		5 A	
		10 A	1 mA
		20 A	
Allowable crest factor			6
Accuracy *1 *2 *3	Effective input range	Full range	1 % to 120 % of range
	45 Hz ≤ f ≤ 66 Hz LPF:ON/OFF		± (0.1 % of reading + 0.1 % of range)
	66 Hz< f ≤ 400 Hz LPF:OFF		± (0.1 % of reading + 0.2 % of range)
	400 Hz< f ≤ 1 kHz LPF:OFF		± (0.1 % of reading + 0.2 % of range)
	1 kHz< f ≤ 5 kHz LPF:OFF		± (3 % of range)
Residual noise	Input short circuit LPF:ON/OFF		0.5 % of range
One-year accuracy (accuracy up to 12 months after calibration)			1.5 times the reading errors for the accuracy at 6 months
Auto range	UP condition		When the value exceeds 120 % of the range or when a peak over-range occurs
	DOWN condition		When the value is less than 30 % of the range, the value is less than or equal to 90 % of the next lower range, and a peak over-range is not occurring

*1 Under the following conditions: within the effective input range, within six months after the last calibration, at a temperature of 23 °C ± 5 °C, sine wave, power factor of 1, and common mode voltage of 0 V.
If the waveform is asymmetrical (waveforms such as half-wave rectified waveforms and full-wave rectified waveforms), errors will occur.
*2 When you are using the 5 mA range and the input is less than 10 % of the range, add (0.1 % of range).
*3 The peak current accuracy is defined for a sine wave whose frequency is between 45 Hz and 66 Hz. Accuracy: ± (0.1 % of reading + 3.1 % of range)

Power measurement function			
Measurement range (combination of voltage range and current range)	Resolution	750 mW	0.01 mW
		1.5 W	0.1 mW
		3 W	
		6 W	
		7.5 W	
		15 W	1 mW
		30 W	
		60 W	
		75 W	
		150 W	0.01 W
		300 W	
		600 W	
		750 W	
		1.5 kW	0.1 W
		3 kW	
		6 kW	
Accuracy *1 *2	Effective input range	Full range	1 % to 144 % of range
	45 Hz ≤ f ≤ 66Hz LPF:ON/OFF		± (0.1 % of reading + 0.1 % of range)
	66 Hz < f ≤ 400Hz LPF:OFF		± (0.1 % of reading + 0.2 % of range)
	400 Hz < f ≤ 1kHz LPF:OFF		± (0.1 % of reading + 0.3 % of range)
	1kHz < f ≤ 3kHz LPF:OFF		± (3 % of range)
Effect of power factor	Power factor 0	45 Hz to 66 Hz	±0.4 % of VA
	0 < Power factor < 1		Add (tan θ × 0.4)% of reading
One-year accuracy (accuracy up to 12 months after calibration)			1.5 times the reading errors for the accuracy at 6 months

*1 Under the following conditions: within the effective input range, within six months after the last calibration, at a temperature of 23 °C ± 5 °C, sine wave, power factor of 1, and common mode voltage of 0 V.
If the waveform is asymmetrical (waveforms such as half-wave rectified waveforms and full-wave rectified waveforms), errors will occur.
*2 When you are using the 5 mA range and the input is less than 10 % of the range, add (0.1 % of range).

KPM1000 Specifications

Frequency measurement function	
Measurement range	10 Hz to 10 kHz
Measurement target	Voltage/current
Measurement input level	30 % to 120 % of measurement range
Frequency filter	ON (cutoff frequency 500 Hz)/OFF
Accuracy	± (0.06 % of reading)

Math features		
Apparent power *1 *2		VA = V, A
Reactive power *1 *2		var = $\sqrt{(VA)^2-W^2}$
Power factor *1 *2		PF = W/VA
Phase angle *1 *2		deg = $\cos^{-1}$(W/VA)
Crest factor *1 *2		Peak value/effective value
Moving average (averaging)		OFF/ 2/ 4/ 8/ 16/ 32/ 64
Selectable range for the PT ratio		1 to 2000 in steps of 1
Selectable range for the CT ratio		1 to 2000 in steps of 1
Accuracy of leading phase and lagging phase detection	The voltage and current input is 50 % to 120 % of the measurement range. 45 Hz ≤ f ≤ 1 kHz LPF: Off	±10 °

*1 This is determined through a digital computation using the voltage, current, and active power. For distorted signal input, the value obtained on the KPM1000 may differ from that obtained on other instruments that use a different method.
*2 The measurement accuracy is determined by an expression whose components are the measurement accuracies of the voltage, current, and active power.

Integration feature		
Integration	Accuracy	±(accuracy of the power or current + 0.1 % of reading)
Timer *1	Selectable range	0 hours 00 minutes to 9999 hours 59 minutes
	Accuracy	±0.02 %

*1 You can use the timer setting to automatically stop integration.

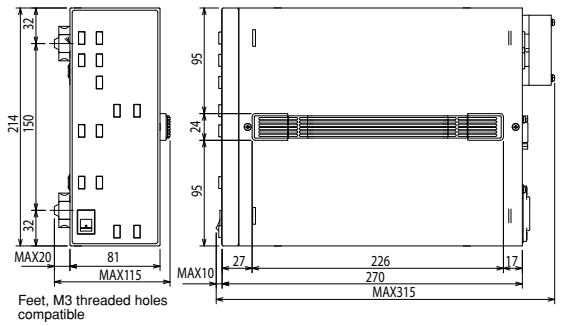
Other functions	
Synchronization source	Voltage/current/OFF (all display update intervals)
Display hold	Holds measured value. Possible to switch display items (measurement items).

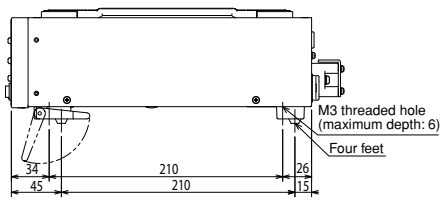
Communication function
RS232C (standard), GPIB/USB (select either, factory option)

General specifications		
AC input	Nominal input rating	100 V to 240 V, 50 Hz to 60 Hz
	Voltage range	90 V to 250 V
	Maximum power consumption	70 VA
Withstand voltage	Between the voltage and current input terminals and the chassis and interface	1980 Vac for 5 minutes
	Between the voltage and current input terminals and the AC input	
	Between the voltage input terminals and the current input terminals	
	Between the AC input and the chassis	1500 Vac for 1 minute
Insulation resistance	Between the voltage and current input terminals and the chassis and interface	100 MΩ or greater at 500 Vdc
	Between the voltage and current input terminals and the AC input	
	Between the voltage input terminals and the current input terminals	
	Between the AC input and the chassis	
Environmental conditions	Operating environment	Indoor use, overvoltage category II
	Operating temperature	0 to +40
	Operating humidity	20 %rh to 80 %rh (There shall be no condensation.)
	Storage temperature	-20 to +70
	Storage humidity	90 %rh or less (There shall be no condensation.)
	Altitude	2000 m or less
Earth continuity		0.1 Ω or less at 25 Aac
Safety *1		Complies with the requirements of the following directive and standard Low Voltage Directive 2006/95/EC *2 EN61010-1, class I, pollution degree 2
Electromagnetic compatibility (EMC) *1 *2 *3		Complies with the requirements of the following directive and standard EMC Directive 2004/108/EC EN 61326-1 Compliance condition: The maximum length of all cabling and wiring connected to the KPM1000 must be less than 3 m.
Dimensions		See the outline drawing
Weight		Approx. 2.5 kg (5.51 lb.)
Accessories	Power cord (three-pronged)	1
	Safety plugs (solder-connection type)	1 set (red and black)
	CD-ROM *4	1
	Quick start	English: 1, Japanese: 1
	Safety information	1 (contains English, Chinese, and Japanese)
	Packing list	1 (contains both English and Japanese)

*1 Does not apply to specially ordered or modified KPM1000s.
*2 Limited to products that have the CE mark on their panels.
*3 The measured values may be affected by noise.
Use shielded cables for the communication cables. The act of connecting measuring cables may cause radio interference, in which case users may be required to correct the interference.
*4 Contains the User's Manual, the Communication Interface Manual, and the KI-VISA library.

External Dimensional Diagrams

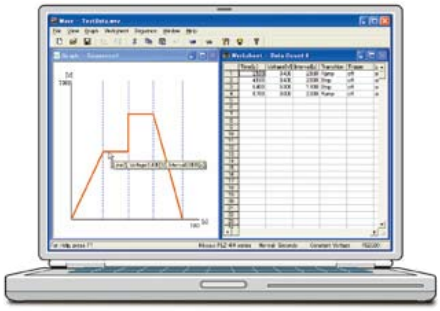




Units: mm

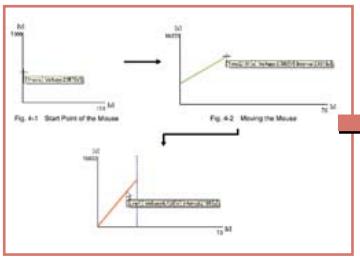
Application Software for Power Supplies and Electronic Loads

WAVY Series

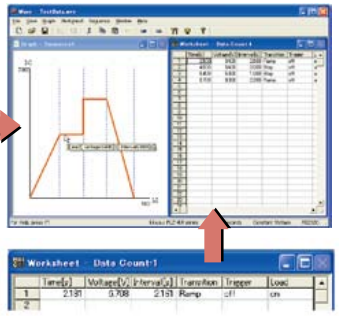


Easy-to-operate software expanding functions of power supplies and electronic loading units

WAVY is sequence creation software that supports the power supplies and electronic loads from KIKUSUI Electronics Corp.
You can use WAVY to create and edit sequences easily with a mouse. During sequence execution, you can also display execution points for visualization to monitor voltage, current, and other parameters and save them as a file.



Data now created with a mouse is displayed as shown on the right.



* When adding data, you can also enter the data directly in data cells.

Features

- Easy operation for waveform images by using a mouse
- Sequence data can be edited easily.
- Sequence data can be stored easily.
- Four types of interfaces are available.
  (RS-232C, GPIBs from NI, INTERFACE, and CONTEC)
- Text files can be read freely.

Operating Environment

- CPU: Pentium Ⅳ or later
- OS: Windows XP, Windows 2000, Windows Me
- Memory: 128MB or more (recommended)
- Interface: RS-232C. An RS-232C cross-over cable is required.

Lineup

Model	Version	Hardware Sequence *1	Software Sequence *2	Operation Mode
Wavy for PBZ	6.0	✔ (1024 steps)	-	CC, CV/DC, AC+DC
Wavy for PAS & PWR	5.0	-	✔ (1024 steps)	CV, CC
Wavy for PCR-LE	5.4	✔ (1024 steps)	-	AC, DC, AC+DC
Wavy for PLZ-4W	4.0	✔ (Normal mode: 256 steps, Fast mode:1024 steps)	-	CV, CC, CR+CP
Wavy for PLZ-U	3.1	✔ (256 steps)	✔ (1024 steps)	CC, CV, CR, CC + CV, CR + CV
Wavy for PCR-M	5.1	-	✔ (2048 steps)	CV (AC, DC, AC+DC)
Wavy for PCZ1000A	6.0	-	✔ (10080 steps)	CC, CR, CP
Wavy for PWX	6.0	✔ (1024 steps)	-	CV, CC

*1 "Hardware Sequence" is to control the equipment using built-in sequence function of the unit.
*2 "Software Sequence" is to control the sequence using "Wavy"

DRIVERS

The instrument drivers uploaded on our website are free to download for your convenience.

	IVI-COM	IVI-C	VisualBasic 6.0	LabVIEW	Lab Windows/CVI
Test and Measurement Instruments					
KFM2030	✔		✔(IVI-COM)		
TOS9200/9201			✔		
TOS6210/6200			✔		
Power Supply Controllers					
PIA4800 Series	✔ (IviDCPwr)	✔ (IviDCPwr)	✔(IVI-COM)	✔(IVI-C)	✔(IVI-C)
AC Power Supplies					
PCR-LE Series	✔ (IviACPwr)	✔ (IviACPwr)	✔(IVI-COM)	✔(IVI-C)	✔(IVI-C)
PCR-M Series	✔	✔	✔(IVI-COM)	✔(IVI-C)	✔(IVI-C)
Electronic Loads					
PLZ Series (4W/4WL/4WH/U)	✔	✔	✔(IVI-COM)	✔(IVI-C)	✔(IVI-C)
PCZ1000A	✔	✔	✔(IVI-COM)	✔(IVI-C)	✔(IVI-C)
Common Libraries					
VISA	KI-VISA				
IVI	IVI Shared Components				

Note: For details of the operation condition, please refer to our web site.

Rack Mount

Various Kikusui products can be easily mounted in a rack by using a bracket and rack mount frame, rack adaptor, etc.

JIS standards (millimeter size) and EIA standards (inch size) racks are available. Brackets and rack mount frames, rack adaptors, etc. applicable to each type are also available.

Since the width of one panel is 50mm for JIS Standards and 44.45mm for EIA Standards, the bracket and rack mount frame, etc. of the panel width matched to the product body are selected based on one panel width.

Racks

The KRO Series are designed in accordance with both JIS Standards and EIA Standards. Since these racks are equipped with support angle as standard, even heavy products can be mounted. (With products weighing more than 70kg, use a rack with brackets.)

The KRO Series conforms both JIS and EIA standards simply replacing the front panel with the rear panel.

The KRC series is a multifunctional decorative rack that is based on a steel cabinet rack and designed to allow the attachment of various rack options.

In addition to having models that meet two different standards (JIS and EIA) and being available in two overall heights (1,835 mm and 1,435 mm), this series comes in depths of 800 mm and 950 mm (two types), giving it eight models in all. Also, additional support angles (two types), base fittings and suspension eyebolts are available as separately sold options.

The Enclosed Type Rack (Custom product on request)

The rack system that will be used for concerning the heat generated from the Power Supplies, considerable amount of the dust as an environmental condition, metal corrosion occurred such as at plating factory, an electrolytic chemical synthesis factory.

(*The water cooled unit will be built in the system which require for the water pipe and drain)

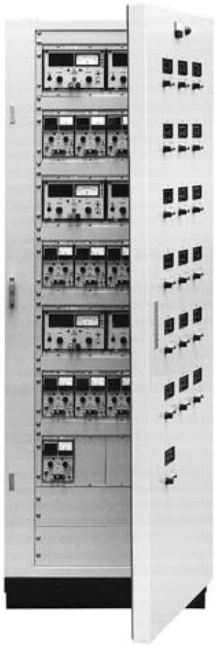
Model		Pay load weight	Number of panels		Overall height	Weight	The length for maximum surface	Support angle	Support leveler	Options		
		kg	JIS	EIA	mm	kg				Support angle	Base hold angle	Eyebolt
Open rack (KRO series)	KRO1600	Approx. 300	32	36	1825	55	700	12 (6 pairs)	4			
	KRO1250		25	28	1475	50		10 (5 pairs)				
	KRO900		18	20	1125	45		8 (4 pairs)				
Decorative rack (KRC series)	KRC363L	Approx. 300		36	1835	95	950	12 (6 pairs)	4	OP01-KRC OP02-KRC *1	OP03-KRC *2	OP04-KRC *3
	KRC273L			27	1435	85		10 (5 pairs)				
Decorative rack (KRC series) Production item upon order	KRC363	Approx. 300		36	1835	90	800	12 (6 pairs)	4			
	KRC273			27	1435	75		10 (5 pairs)				
	KRC1603		32		1835	90	800	12 (6 pairs)				
	KRC1603L					95	950					
	KRC1203		24		1435	75	800	10 (5 pairs)				
	KRC1203L					85	950					

• The KRO Series payload weight can be increased to approximately 400kg by changing the casters.
• The KRO Series are sold in kit form.
• The support angle is designed for Kikusui racks and products. It is not interchangeable with products of the other manufacturer.
*1 These support angles (OP01-KRC) are equivalent to the support angles incorporated into the main rack unit.
They come in a two-item (1-pair) set. When the product weight exceeds 70 kg, use a weight support angle (OP02-KRC).
*2 These L-shaped fittings (OP03-KRC) secure the base of the rack to the floor. The set includes four main fitting components and the bolts and nuts that secure the fittings to the bases.
*3 These eyebolts (OP04-KRC) are specially made for the KRC series. The set includes four M12 eyebolts.

KRO Series

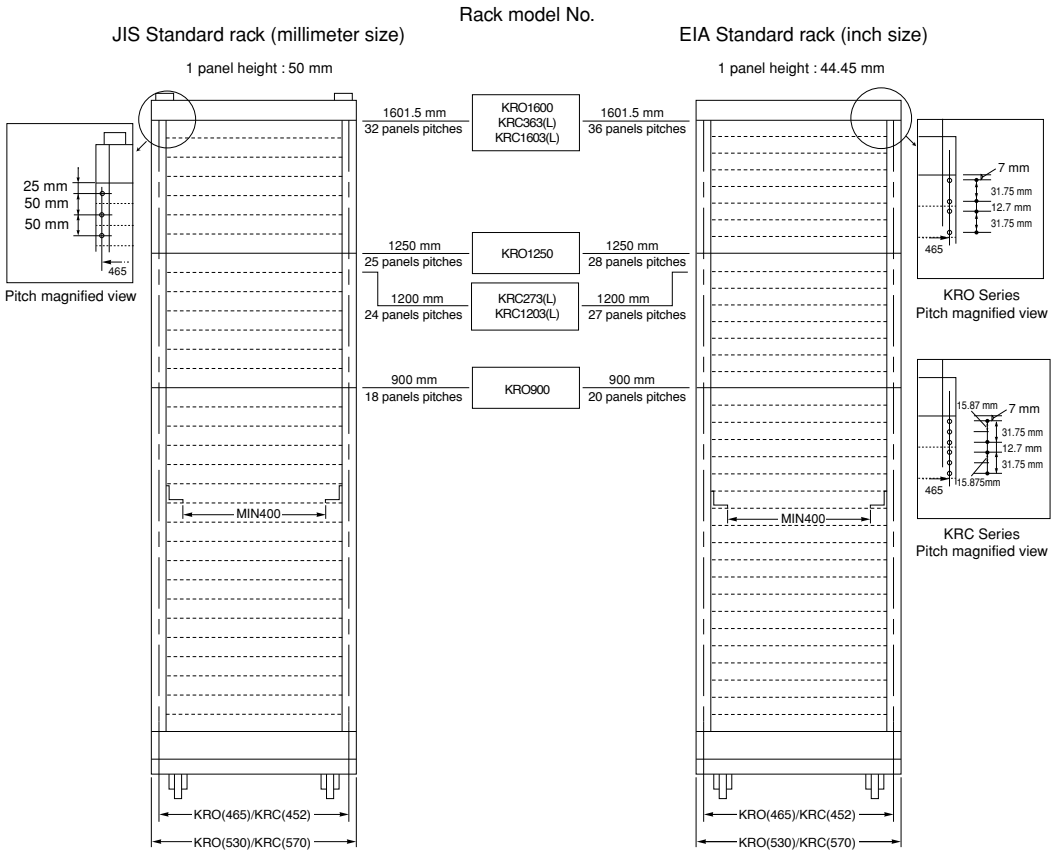
KRC Series

The Enclosed type rack



[NOTICE]
Please use supporting angles (reinforcing cramps).
When mounting product by using rack mount frame, rack adapter, and bracket, please make sure to support the mounted product by using the supporting angle (reinforcing cramps) capable of bearing the product load.

Racks Mount



Racks & Accessories

■ For use with rack mounting frame and special brackets

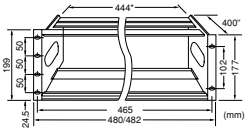
RMF4 and RMF4M are rack mount frames to be used with standard racks. Designed to meet the EIA/JIS standards, they are used to install models ranging from 1/2 rack to 1/6 rack in width using a rack mount frame bracket.

Complied products
- PAN-A Series
- PIA4810
- PIA4820

RMF-4M

Blank panel (sold separately)

RMF-4



■ Bracket

The bracket can be used to install models of 1 (1/1) rack in width directly in the rack.

Sample for the bracket (Pair of right and left portion)

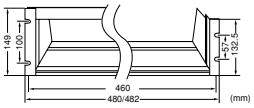
■ For use with rack adapter

KRA3 and KRA150 are rack adapters conforming to EIA/JIS standards to be used with standard racks. Power supplies can be stored without using brackets.

Complied products
- PWR Series (400/800 W)
- PAS Series
- PMC-A Series
- PMC Series
- PCR500M
- PLZ-4W Series (TYPE I)
- PLZ334WL
- PLZ-4WH Series (TYPE I)
- PFX2511
- PMR Series
- PIA4800 Series

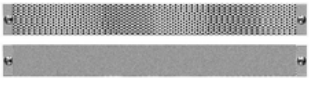
KRA150

KRA3



■ Blank panel

When using brackets to install models liable to give off heat, it is necessary to provide at least the minimum number of blank panels required for each model. Plate-type panels and mesh-type blank panels are also available.



Sample for the blank panel

EIA Standard Rack (Inch Size) Mounting Options

	Product name			Bracket		Blank panel	Rack mount frame			Rack adapter	
	Series	Type	Width	Bracket model No.	Panel width(*)	"M" is added for mesh type	Rack mount frame model No.	Panel width(*)	Bracket necessary when fastening mainframe to rack mount frame	Rack adaptor model No.	Panel width(*)
DC power supply	PAN-A	0	1/4			BP191-M	RMF4	4(*1)	B42		
		I2[I3]	1/2			BP191-M	RMF4	4(*1)	B22		
	PAS	I	1/6							KRA3	3
		II	1/3							KRA3	3
		III	1/2							KRA3	3
	PWR	400	1/4							KRA3	3
		800	1/2							KRA3	3
		1600	1	KRB3-TOS	3						
	PBZ		1	KRB3-TOS	3						
	PMC-A/PMC		1/4			BP191-M				KRA3(*2)	3
	PMR		1/3			BP191-M				KRA3(*1)	3
AC power supply	PCR-M	500	1/2							KRA3	3
		1000/2000	1	KRB3-TOS	3						
	PCR-LE	500	1	KRB4	4						
		1000	1	KRB6	6						
		2000	1	KRB9	9						
Electronic Load	PLZ-4W	I	1/2							KRA3	3
		II	1	KRB3-TOS	3						
	PLZ-4WL		1/2							KRA3	3
	PLZ-4WH	I	1/2							KRA3	3
		II	1	KRB3-TOS	3						
	PLZ-U	PLZ-30F	2/3	KRB3-PLZ-30F	3						
		PLZ-50F	1	KRB3-PLZ-50F	3						
	PCZ1000A		1	KRB3	3						
Power supply controller	PIA4810/PIA4820		1/3			BP191-M	RMF4	4(*1)	B2-PIA4810/4820	KRA3	3
	PIA4830		1/6			BP191-M				KRA3	3
*3	PFX2511		1/2							KRA3	3

* : EIA panel width is 44.45mm (1 3/4 inch). The panel width does not include the rubber feet, casters, and levelers.
*1: Since there are force-aid cooling intake holes in the side or top and bottom of the mainframe, when mounting in the rack, the blank panel at least 1 panel wide must be installed.

*2: Since those applied models were designed for the type of "Natural Cooling" unit, so it is required to have countermeasure for enough radiation of the heat when used with rack mounting system.
• When PIA4800 power supply controller are rank-mounted together with the power supply, the rank mount frame and rack adaptor are necessary to be added depending on the series of the connected power supply. *3: Battery Tester

JIS Standard Rack (Millimeter Size) Mounting Options

	Product name			Bracket		Blank panel	Rack mount frame			Rack adapter	
	Series	Type	Width	Bracket model No.	Panel width(*)	"M" is added for mesh type	Rack mount frame model No.	Panel width(*)	Bracket necessary when fastening mainframe to rack mount frame	Rack adaptor model No.	Panel width(*)
DC power supply	PAN-A	0	1/4			BP1H-M	RMF4M	4(*1)	B42		
		I2[I3]	1/2			BP1H-M	RMF4M	4(*1)	B22		
	PAS	I	1/6							KRA150	3
		II	1/3							KRA150	3
		III	1/2							KRA150	3
	PWR	400	1/4							KRA150	3
		800	1/2							KRA150	3
		1600	1	KRB150-TOS	3						
	PBZ		1	KRB150-TOS	3						
	PMC-A/PMC		1/4			BP1H-M				KRA150(*2)	3
	PMR		1/3			BP1H-M				KRA150(*1)	3
AC power supply	PCR-M	500	1/2							KRA150	3
		1000/2000	1	KRB150-TOS	3						
	PCR-LE	500	1	KRB200	4						
		1000	1	KRB300	6						
		2000	1	KRB400-PCR-LE	8						
Electronic Load	PLZ-4W	I	1/2							KRA150	3
		II	1	KRB150-TOS	3						
	PLZ-4WL		1/2							KRA150	3
	PLZ-4WH	I	1/2							KRA150	3
		II	1	KRB150-TOS	3						
	PLZ-U	PLZ-30F	2/3	KRB150-PLZ-30F	3						
		PLZ-50F	1	KRB150-PLZ-50F	3						
	PCZ1000A		1	KRB150	3						
Power supply controller	PIA4810/PIA4820		1/3			BP1H-M	RMF4	4(*1)	B2-PIA4810/4820	KRA150	3
	PIA4830		1/6			BP1H-M				KRA150	3
*3	PFX2511		1/2							KRA150	3

* : JIS panel width is 50mm. The panel width does not include the rubber feet, casters, and levelers.
*1: Since there are forced-air cooling holes in the side or top and bottom of the mainframe, when mounting in the rack, the blank panel at least 1 panel width must be installed.

*2: Since those applied models were designed for the type of "Natural Cooling" unit, so it is required to have countermeasure for enough radiation of the heat when used with rack mounting system.
• When PIA4800 Power Supply Controller are rack-mounted together with the power supply, the rack mount frame and rack adaptor are necessary to be added depends on the series of the connected power supply. *3: Battery Tester

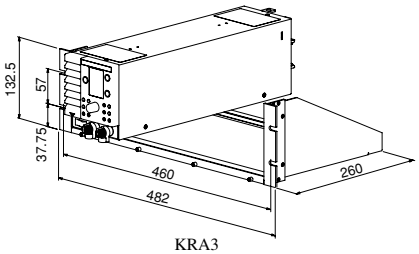
PWR Series External Dimensional Diagrams / Rack Mount Option

Unit:mm

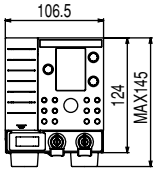
■ 400W TYPE (4 units can be rack mounted)

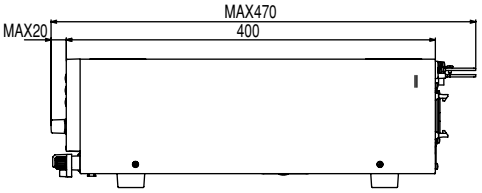
PWR400L/PWR400M/PWR400H

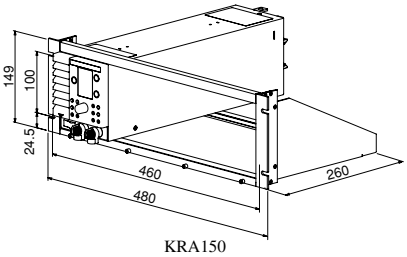
Output (Rear) M8
(Front) M6
Input AC inlet
Accessory power cable
approx. 2.4 m long



KRA3





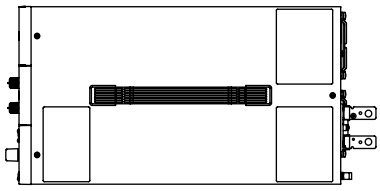


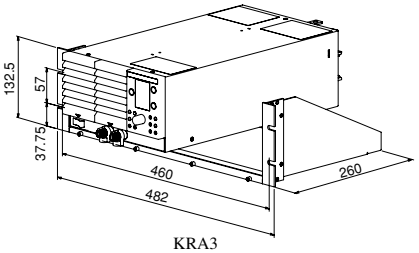
KRA150

■ 800W TYPE (2 units can be rack mounted)

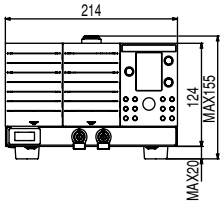
PWR800L/PWR800M/PWR800H

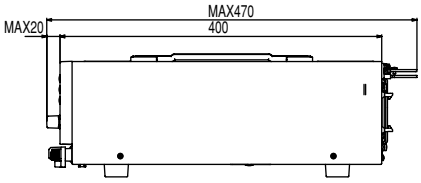
Output (Rear) M8
(Front) M6
Input AC inlet
Accessory power cable
approx. 3 m long

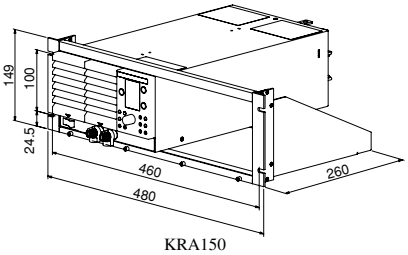




KRA3





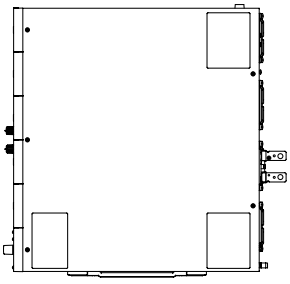


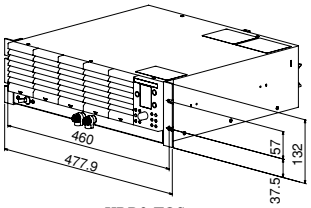
KRA150

■ 1600W TYPE

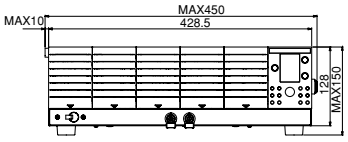
PWR1600L/PWR1600M/PWR1600H

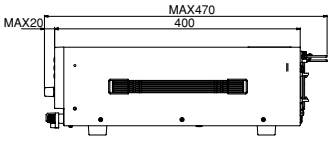
Output (Rear) M8
(Front) M6
Input Terminal M4
Accessory power cable
approx. 3 m long

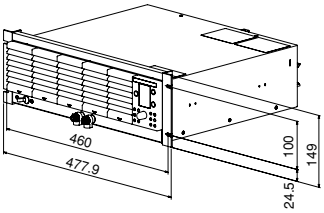




KRB3-TOS







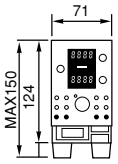
KRB150-TOS

PAS Series External Dimensional Diagrams / Rack Mount Option

Unit:mm

■TYPE I

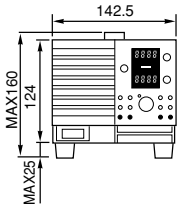
PAS10-35/PAS20-18
PAS40-9/PAS60-6
PAS80-4.5/PAS160-2
PAS320-1/PAS500-0.6



Output M8 bolt
Input AC inlet
Attached power cable
SVT3 18AWG 3P plug, with connector Cable length 2.4m

■TYPE II

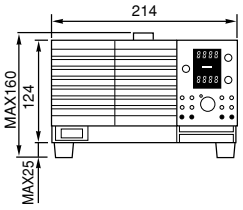
PAS10-70/PAS20-36
PAS40-18/PAS60-12
PAS80-9/PAS160-4
PAS320-2/PAS500-1.2



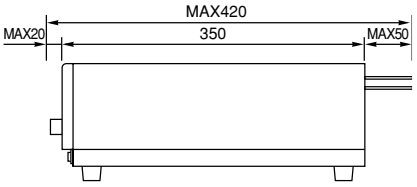
Output M8 bolt
Input AC inlet
Attached power cable
SVT3 18AWG 3P plug, with connector Cable length 2.4m

■TYPE III

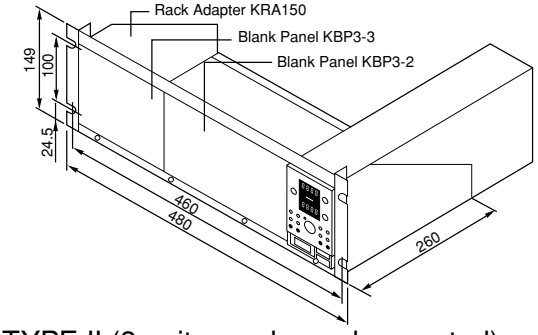
PAS10-105/PAS20-54
PAS40-27/PAS60-18
PAS80-13.5/PAS160-6
PAS320-3/PAS500-1.8

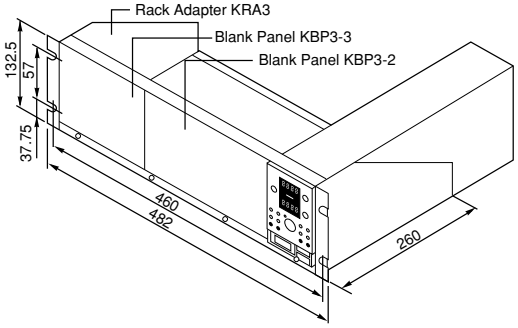


Output M8 bolt
Input Terminal M4
Attached power cable
VCT3 3.5 mm2 plug, without connector Cable length 3m

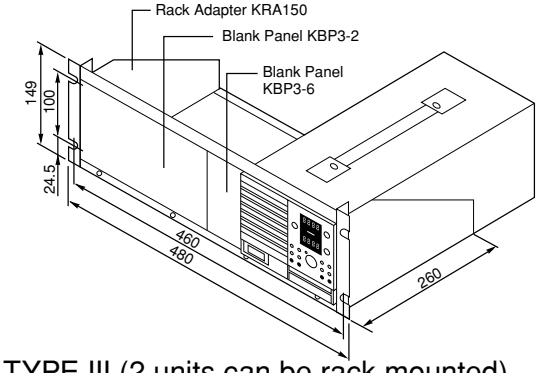


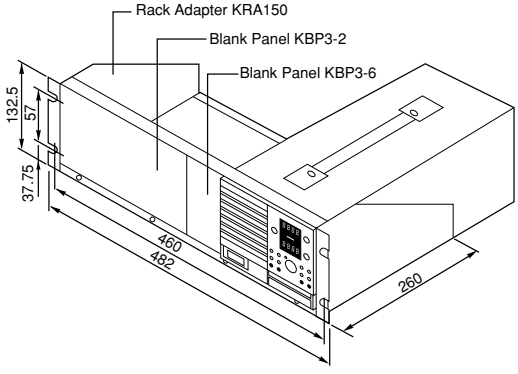
■ TYPE I (6 units can be rack mounted)



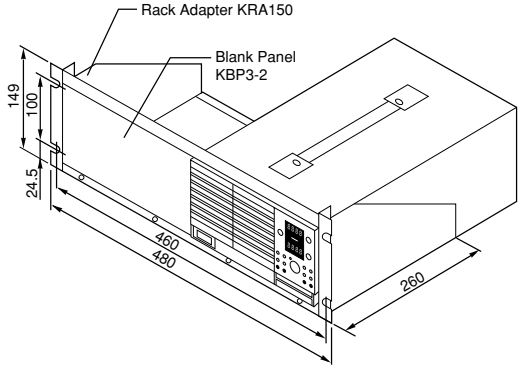


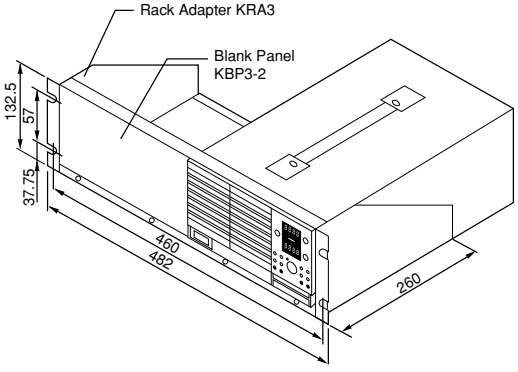
■ TYPE II (3 units can be rack mounted)





■ TYPE III (2 units can be rack mounted)



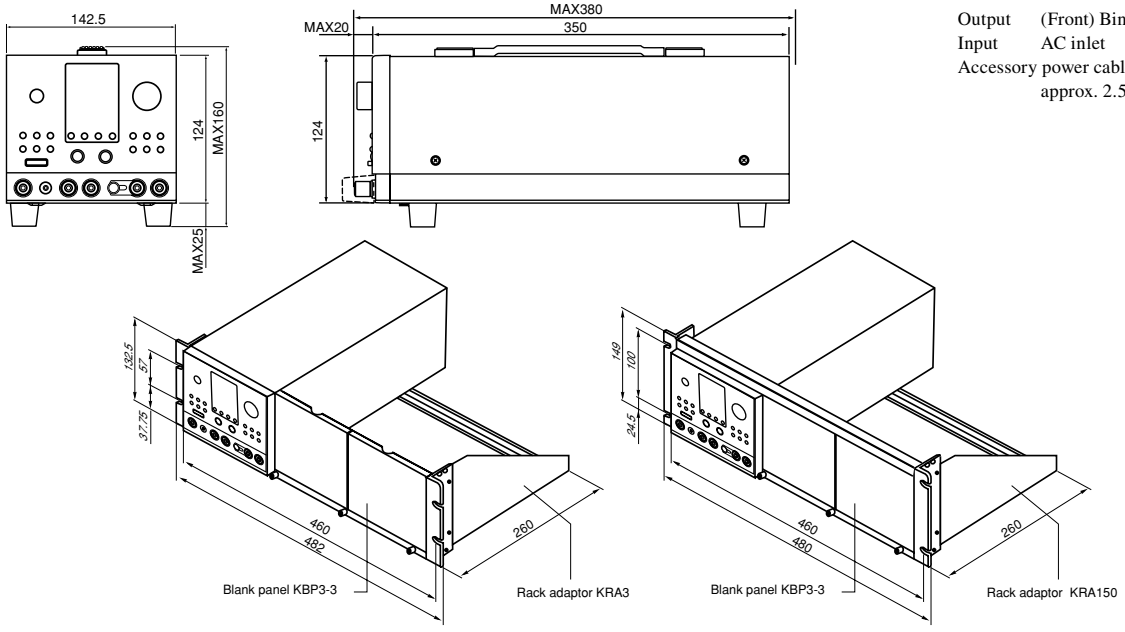


PMR Series External Dimensional Diagrams / Rack Mount Option

(3 units can be rack mounted)

Unit:mm

PMR18-2.5DU/PMR35-1.2DU
PMR18-1.3TR/PMR25-1TR
PMR24-1QU



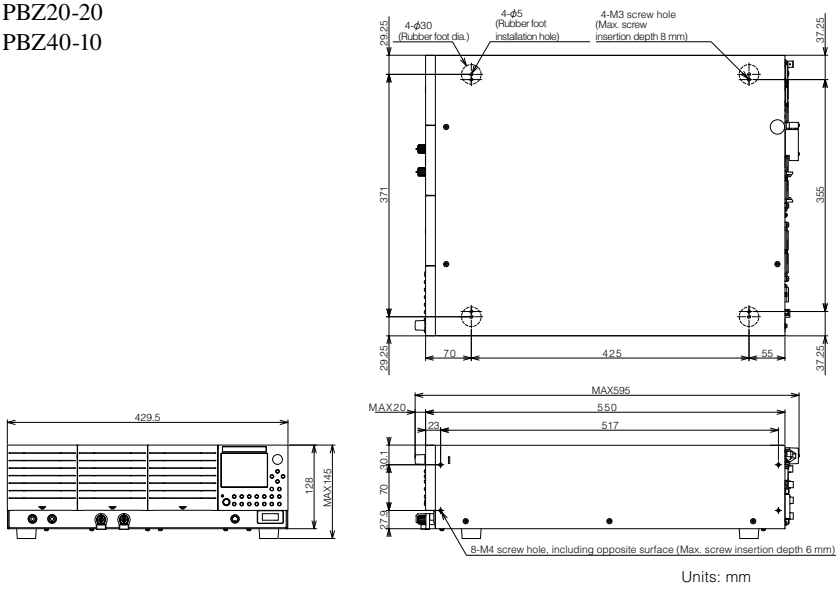
Output (Front) Binding post M6
Input AC inlet
Accessory power cable
approx. 2.5m long

PBZ Series External dimensional diagrams / Rack Mount Option

(3 units can be rack mounted)

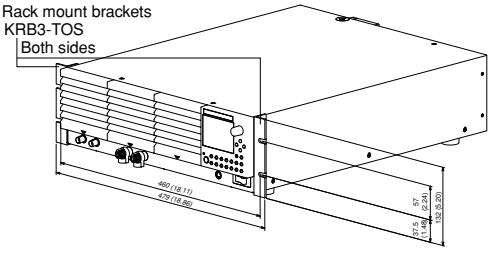
Unit:mm

PBZ20-20
PBZ40-10

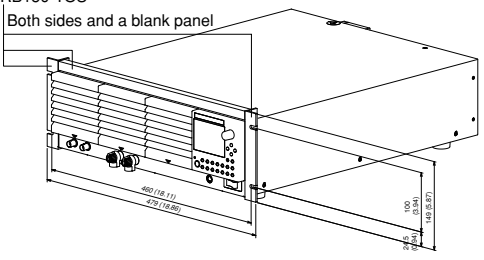


Units: mm

Rack mount brackets
KRB3-TOS
Both sides



Rack mount brackets
KRB150-TOS
Both sides and a blank panel

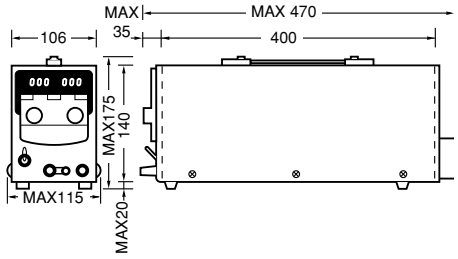


PAN-A Series External Dimensional Diagrams / Rack Mount Option

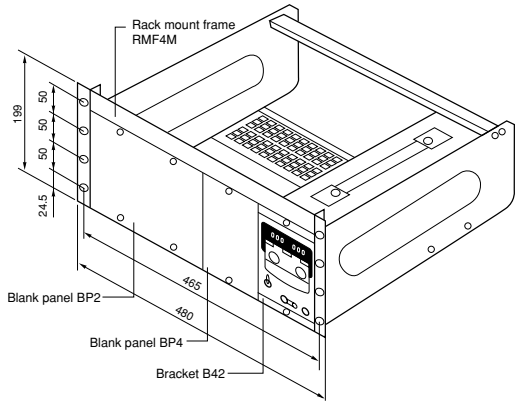
Unit:mm

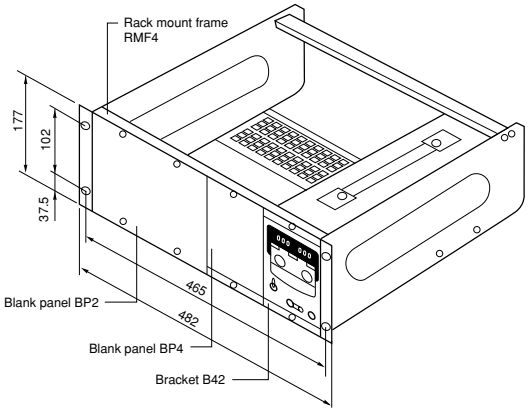
■ 175W TYPE (TYPE 0)
(4 units can be rack mounted)

PAN16-10A/PAN35-5A
PAN60-3A



Output (Rear) Terminal M4
(Front) Binding post M6
(auxiliary output terminal)
Input AC inlet
Attached power cable
SVT3 × 18AWG, approx. 3m long,
with 3P plug

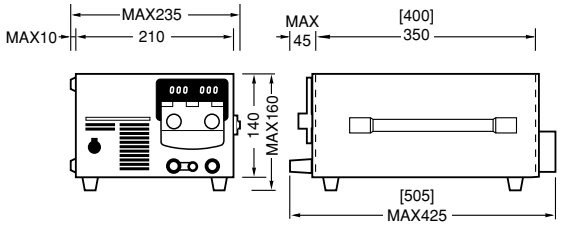




■ 350W TYPE (TYPE I²)/ 700W TYPE (TYPE I³)
(2 units can be rack mounted)

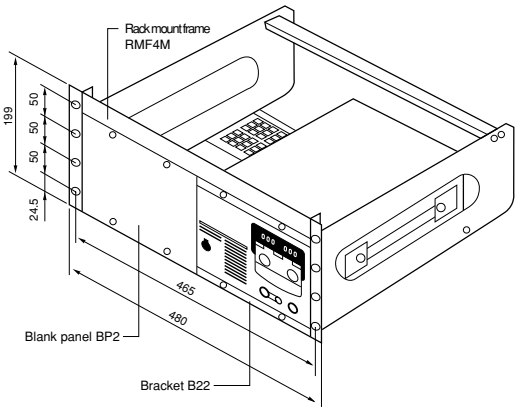
■ 350W TYPE
PAN16-18A/PAN35-10A
PAN60-6A

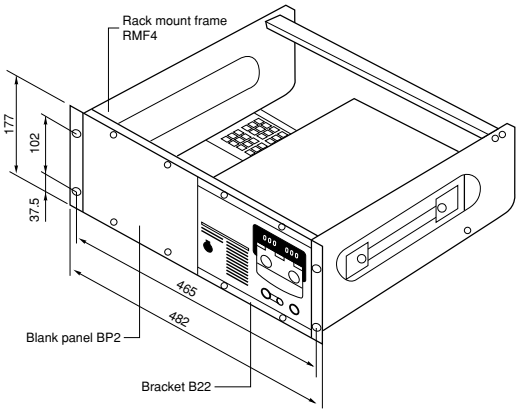
■ 700W TYPE
PAN16-30A/PAN35-20A
PAN60-10A



*[ ] : TYPE I$_3$

Output (Rear) Terminal M4
(Front) Binding post M8
(auxiliary output terminal)
Input 350W Type:AC inlet
700W Type:Terminal M4
Attached power cable
350W Type:SVT3 × 18AWG, approx. 3 m long,
with 3P plug
700W Type:Nominal sectional area 2.0 SQ. mm,
cabtyre cable, with 3P plug, approx. 3m
long(For PAN35-20A: Norminal sectional area 3.5 SQ. mm,cabtyre cable,
approx. 3m long)



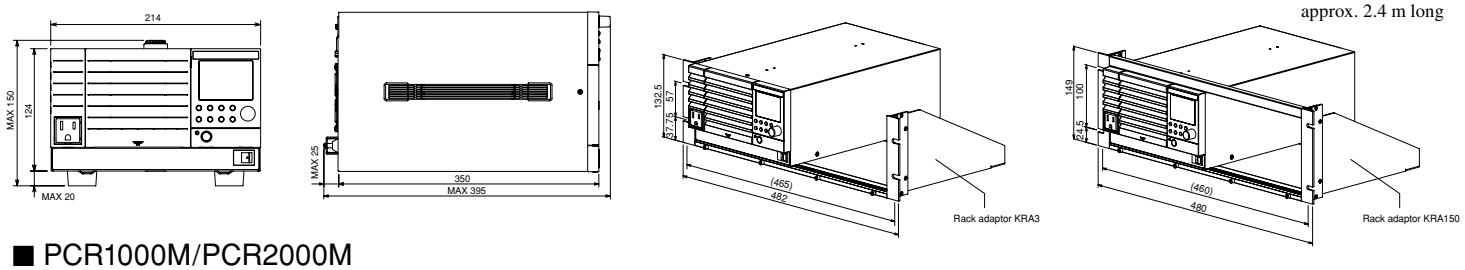


PCR-M Series External Dimensional Diagrams / Rack Mount Option

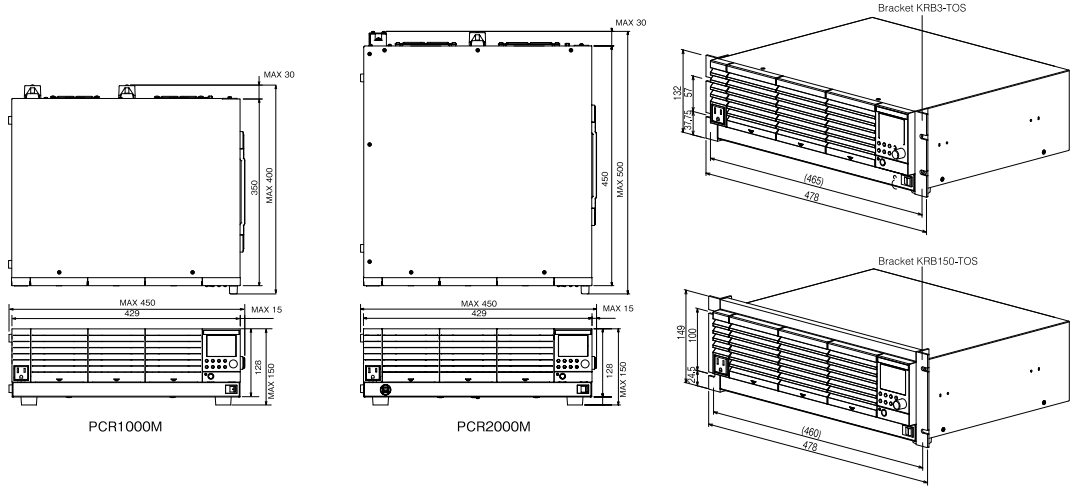
Unit:mm

■ PCR500M (2 units can be rack mounted)

Output (Front) Outlet
(Rear) Terminal M4
Input Terminal M4
Accessory power cable
approx. 2.4 m long



■ PCR1000M/PCR2000M

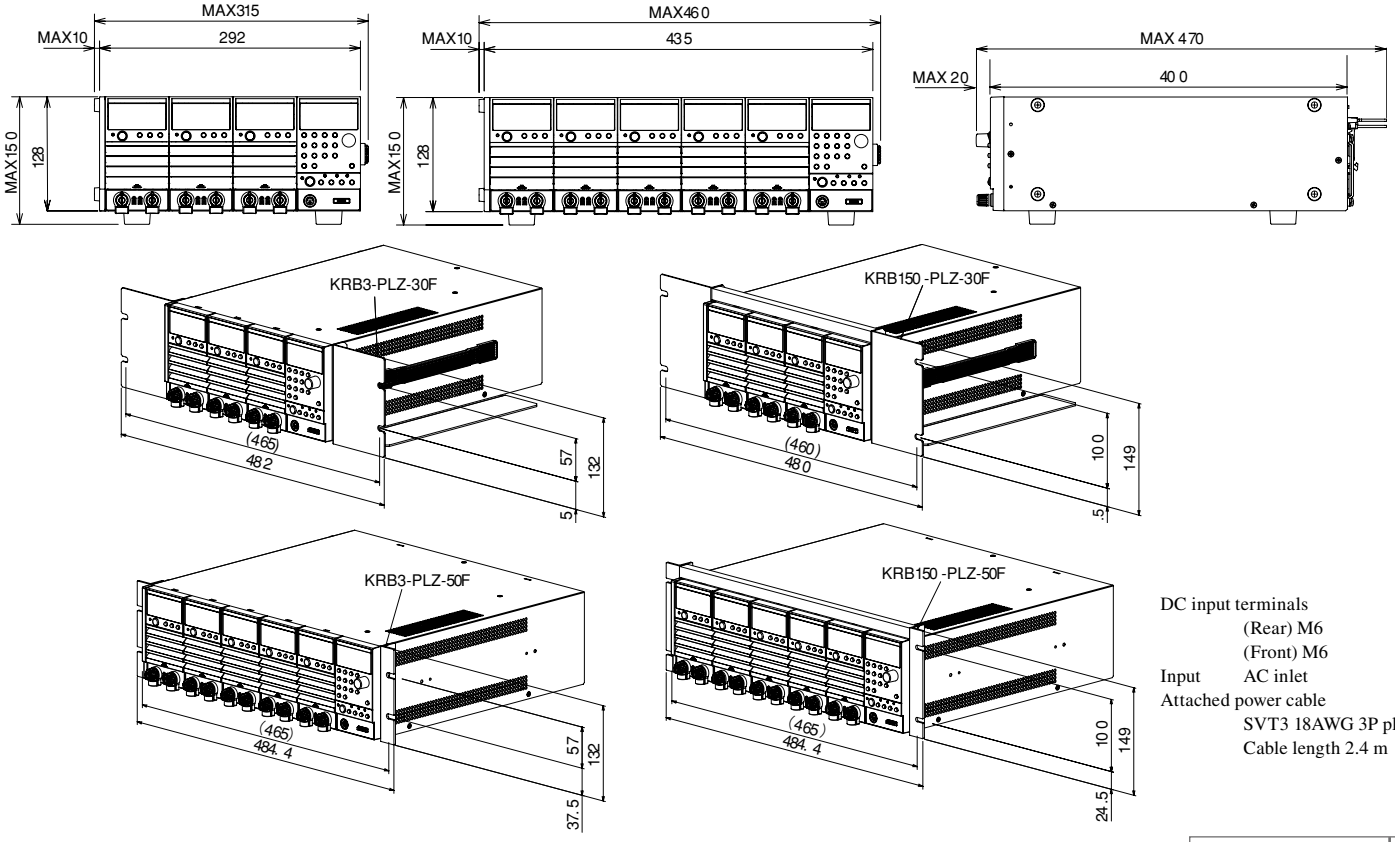


Output (Front) Outlet
(Rear) Terminal M4
Input Terminal M4
Accessory power cable
approx. 3 m long

PLZ-U Series External Dimensional Diagrams / Rack Mount Option

Unit:mm

PLZ70UA/PLZ150U
PLZ30F/PLZ50F

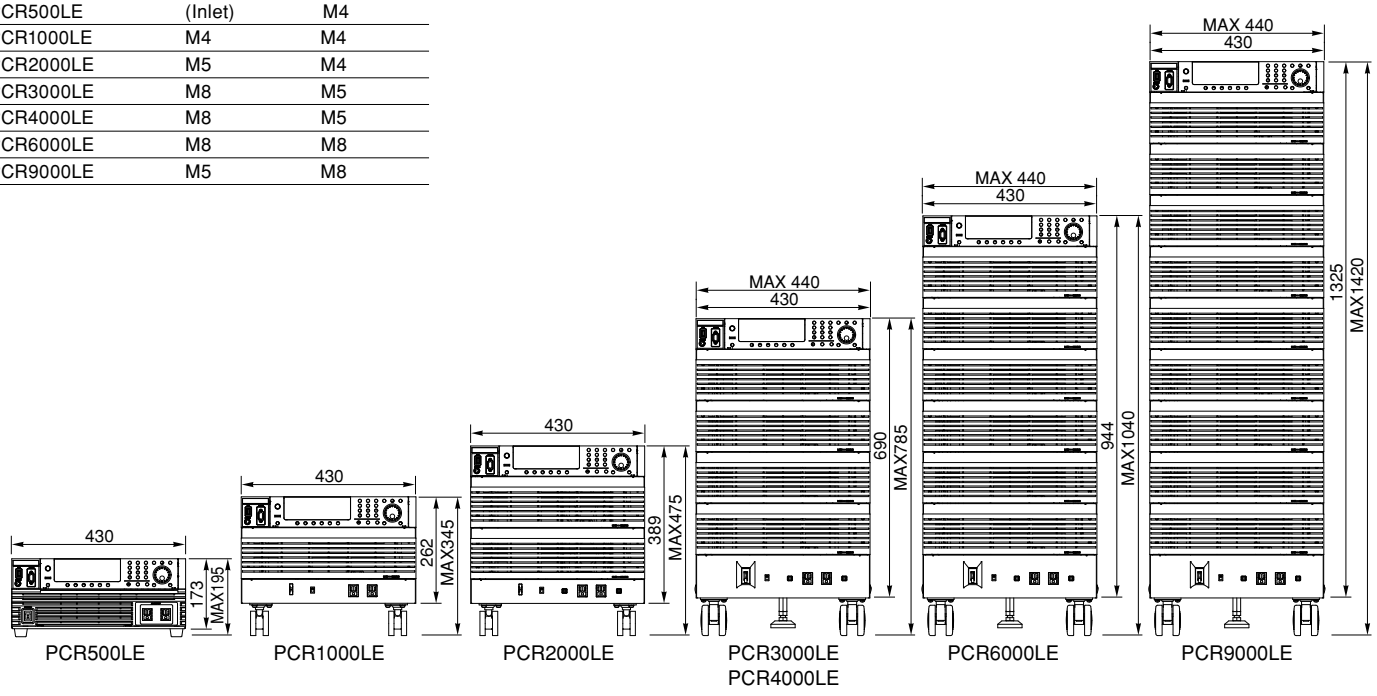


DC input terminals
(Rear) M6
(Front) M6
Input AC inlet
Attached power cable
SVT3 18AWG 3P plug,
Cable length 2.4 m

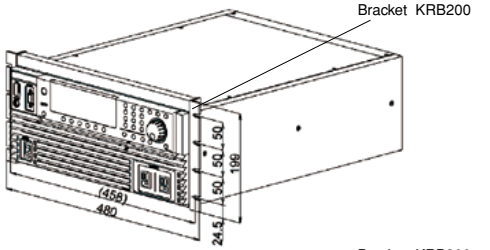
PCR-LE Series External dimensional diagrams / Rack Mount Option

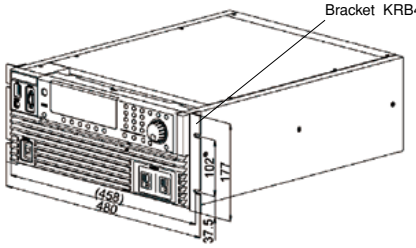
Unit: mm

Model	Input terminal	Output terminal
PCR500LE	(Inlet)	M4
PCR1000LE	M4	M4
PCR2000LE	M5	M4
PCR3000LE	M8	M5
PCR4000LE	M8	M5
PCR6000LE	M8	M8
PCR9000LE	M5	M8

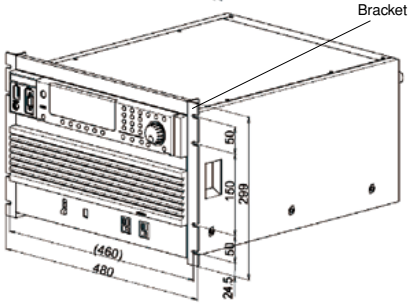


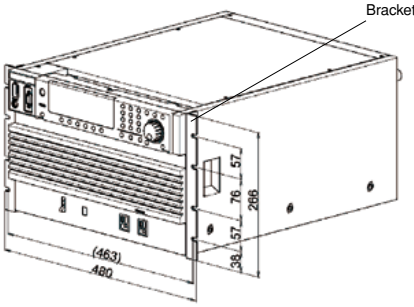
PCR500LE



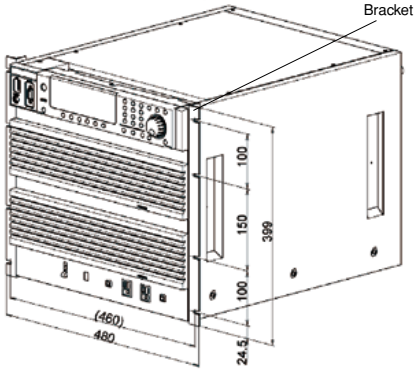


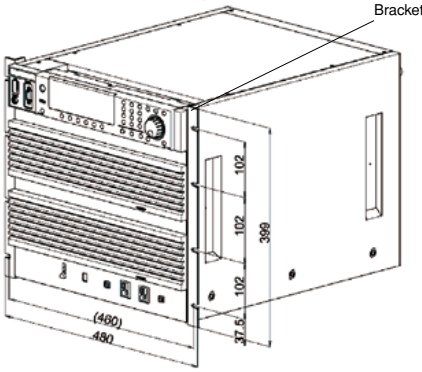
PCR1000LE





PCR2000LE





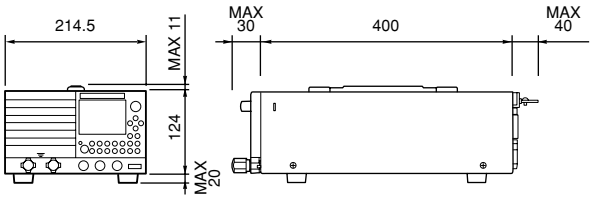
PLZ-4W Series External Dimensional Diagrams / Rack Mount Option

Unit:mm

■ TYPE I (PLZ-4W Series)

(2 units can be rack mounted)

PLZ164W/PLZ334W/PLZ164WA

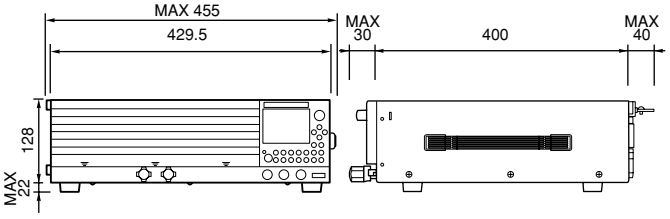


DC input terminals
(Rear) M8
(Front) M6
Input AC inlet

■ TYPE II (PLZ-4W Series)

*The length for Model PLZ2004WB is 550(600)mm

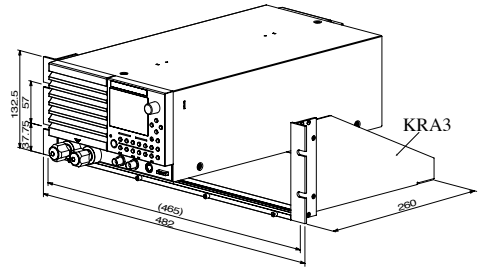
PLZ1004W/PLZ664WA

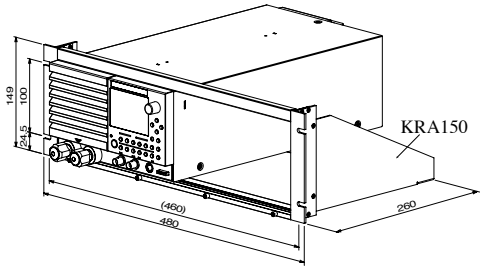


DC input terminals
(Rear) M8
(Front) M6

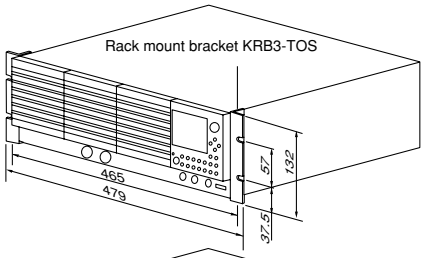
PLZ2004WB
DC input terminals
(Rear) M12
Input AC inlet

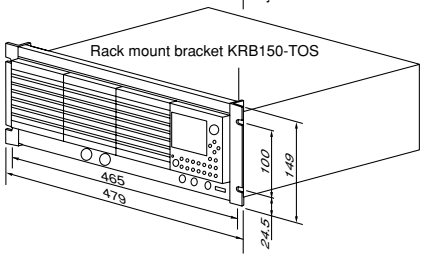
■ TYPE I (PLZ-4W Series)





■ TYPE II (PLZ-4W Series)



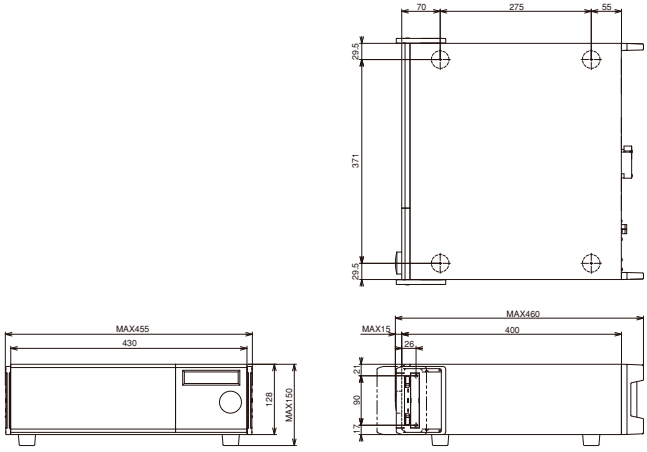


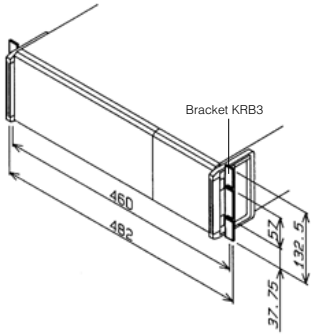
* The front panel for Model PLZ2004WB is designed differently, but external size is the same

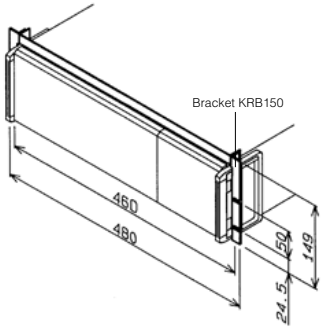
PCZ1000A External dimensional diagrams / Rack Mount Option

Unit:mm

LOADinput (Rear) Terminal M4
Input AC inlet



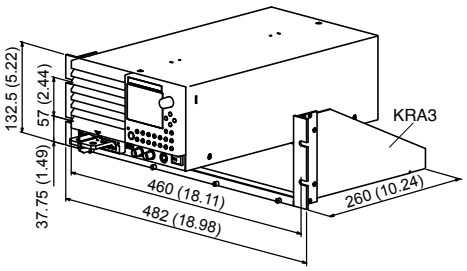


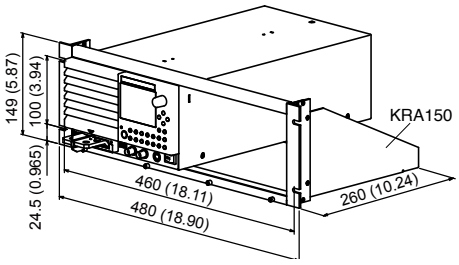


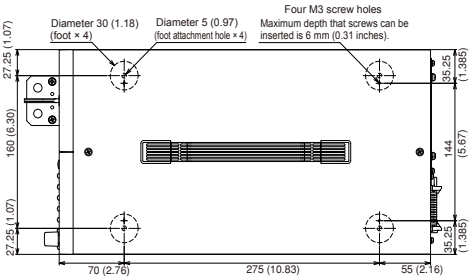
PLZ-4WL Series External dimensional diagrams / Rack Mount Option

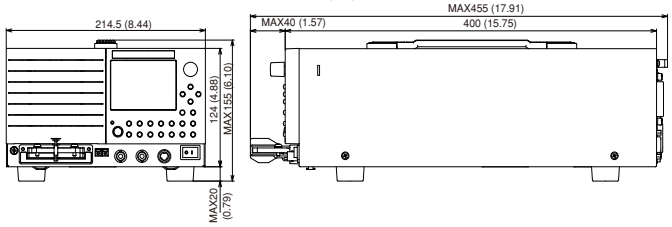
PLZ334WL

Unit:mm







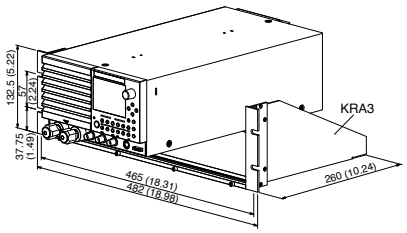


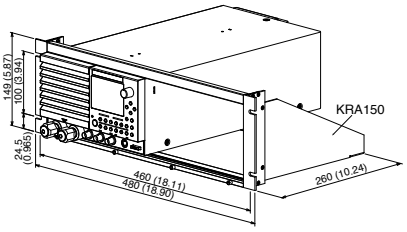
PLZ-4WH Series External dimensional diagrams / Rack Mount Option

PLZ164WH/PLZ334WH/PLZ1004WH
PLZ2004WHB

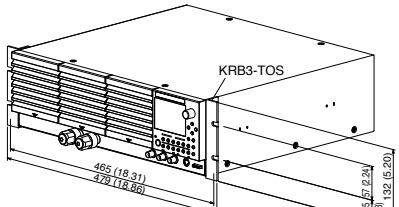
Unit: mm

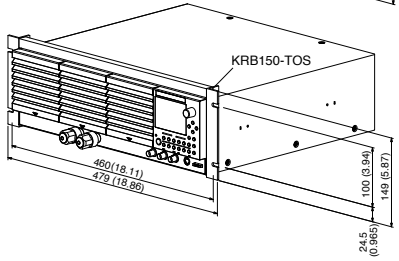
■PLZ164WH, PLZ334WH (Type I)



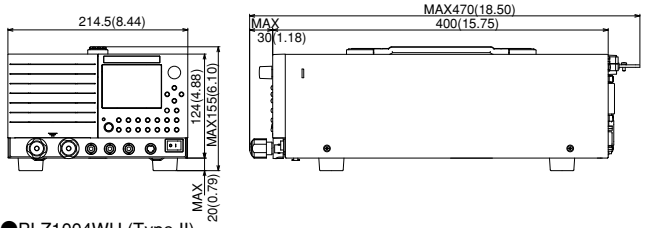


■PLZ1004WH (Type II)

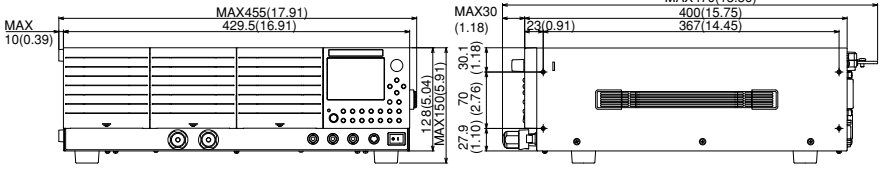




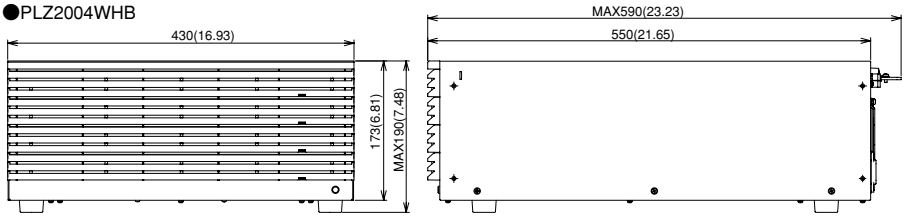
●PLZ164WH, PLZ334WH (Type I)



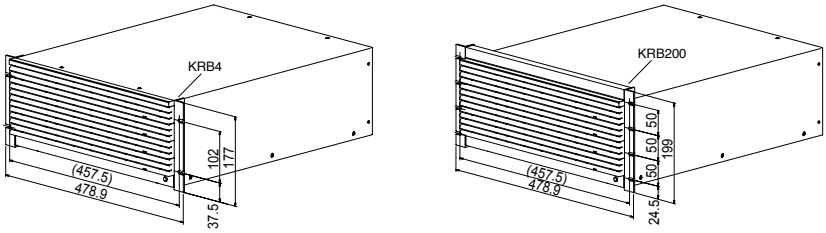
●PLZ1004WH (Type II)



●PLZ2004WHB



■PLZ2004WHB



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